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Electrical World

DECEMBER 26, 1942

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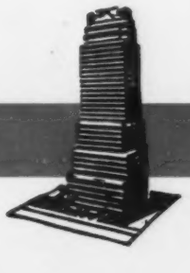

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Ordinarily at this time the business world is appraising the new year with budgets and forecasts, looking forward to the next twelve months as another milestone on the road of opportunity. War changes all that. Today we can budget, but any expenditures beyond our regular operating costs are dependent upon the decision of outsiders. Each day is a period unto itself. There can be no reliable forecasting.

That, however, does not need to deter us from appraising trends and movements. Our present-day judgments may not always be right, but at least they will indicate that besides the war 1943 will present a period of interesting developments in this industry.

In fact, just as a decade before marked a turning point in utility operations, so is it possible that 1943 might mark another turning point—but in the opposite direction. There are marked evidences today that business of all kinds is beginning to understand that government ownership is not necessarily confined to utilities. Public ownership is no longer popular with the public, nor with labor. The utilities have new allies today.

There is also evidence that the public is fed up with bureaucratic regulation that tries to be a law unto itself. Congress is conscious of the encroachment of these agencies upon the law-making prerogatives. Even the courts appear to have regained at least some of their judicial consciousness and are now and then blocking these New Deal agencies.

Perhaps the new year might see some further evidence of this, so far as utilities go. Certainly the opportunity will be presented. If some of the pending cases are decided favorably to the utilities, the whole outlook for the industry, its employees and its suppliers will be vastly altered. Regardless, however, which way the courts decide, it can be seen that 1943 will be one of the most important years in the whole history of the utility business. For our part, we are optimistic.

Strangely enough, there is some likelihood that the new year might see an increase in the number of rate reductions. Companies with increasing nets before taxes need not feel that a greatly increased tax load will be any deterrent. The repeated recommendations in these columns that reserves be built up will, we suspect, be remembered more than once, if perhaps too late, before the year is over.

Consumption can be expected to continue to grow, but more slowly, running perhaps on a level with 1942 by fall. While new loads will continue to be added, there is some reason to believe that in the heavy industrial areas of the East and Middle West the 1942 peak will not be exceeded greatly, if at all.

From this position it would appear that the second year of our participation in the war should offer the utilities fewer problems than the first, with the possibility that it might prove to be a year of good omen—thin in return perhaps, but rich in promise.

New Regulator Controls Generator Rkva. Output

Application of direct-acting regulator to pilot exciter releases much corrective capacity now dormant in dead-band of rheostatic type regulators

J. T. LOGAN, Operating Engineer, Georgia Power Company, Atlanta

DESIRABILITY of continuous control of generator voltage without dead-band has been recognized for some time, but not employed on larger generators until in June, 1941, at Plant Arkwright* because a suitable control system, until then, was not available. The practice provides for the control of voltage without waiting for an appreciable voltage change such as is required to operate contact-making elements before response is obtained. Experience has already shown that it releases capability of rkva. generation not fully realized with rheostatic type regulators because of their inherent dead-band.

Basis for Comparison

Probably the reason so little is known concerning the value of continuous control of voltage is from the lack of authentic performance data of identical generators under the two types of control. The Atkinson steam plant, near Atlanta, is ideally suited for conducting comparative tests in that it is near a large load center and has installed two 60,000-kw. turbo-generators of identical make. No. 1 unit is under control of a rheostatic type voltage regulator which inherently employs a dead-band, while No. 2 unit is under continuous voltage control afforded by the direct-acting type voltage regulator system.

System conditions have been such that the two Atkinson units could be employed individually to demonstrate their performance under identical loading schedules; *i.e.*, No. 2 unit was operated fully loaded on Tuesday, April 28, while No. 1 unit was undergoing repair. On Tuesday, May 5, one week later, when the system load was practically identical with the previous Tuesday's load, No. 1 unit was operated fully loaded, while No. 2 unit was off for inspection.

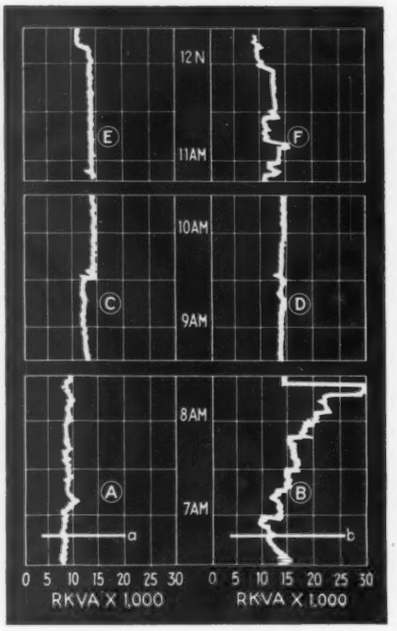


FIG. 1—Facsimile of Plant Atkinson rkva. output charts, July 9, 1942

(A) and (E) No. 1, 60,000-kw. unit under control of rheostatic type voltage regulator. (B) and (F) No. 2, 60,000-kw. unit under control of direct-acting voltage regulator. (C) No. 1 unit under manual voltage control, 8:32 a.m. to 9:35 a.m.; under control of rheostatic type voltage regulator, 9:35 a.m. to 10:35 a.m. (D) No. 2 uhit under manual voltage control. (a) and (b) represent responses of No. 1 and No. 2 units respectively to distant line fault.

Following are some comparisons worthy of mention:

	Unit No. 1	Unit No. 2
1. Date of performance	5-5-42	4-28-42
2. System kw. demand	415,000	413,000
3. Net kw.-hr. output of units	1,487,000	1,504,000
4. Rkva.-hr. output of units, approx.	224,000	285,000
5. Max. rkva. output of units	14,000	23,000
6. Min. rkva. output of units	5,000	2,000
7. Variation in rkva. output	9,000	21,000
8. Stator max. temperature, deg. C.	67	67
9. Voltage variation, percent	1.5	0.25

The above comparison would not be significant except for lines (7) and (9). By holding practically perfect voltage over the 24-hour period No. 2 unit contributed to the system the equivalent of a 21,000-kva. synchronous condenser. No. 1 unit, by being under less exacting voltage control, contributed only the equivalent of a 9,000-kva. synchronous condenser. An examination of the station log indicates that the 9,000-rkva. contribution by No. 1 unit was not always to the best interest of the power system.

The foregoing comparison indicates that the direct-acting regulator in controlling the voltage output of No. 2 unit was to a more pronounced degree regulating the rkva. output. On the surface, it appears that at least 12,000 rkva. in No. 1 unit was being sacrificed in the dead-band of its voltage regulator, rkva. capacity, which ultimately will have to be duplicated in a synchronous condenser unless more effectively controlled.

The effects of continuous control of voltage as indicated above, being much more pronounced in the generator's response to system rkva. demands than was anticipated, called for a more thorough analysis. Consequently, a series of tests was scheduled and conducted on July 9, 1942.

* See "Direct-Acting Regulators on Large Georgia Generators," "Electrical World," May 2, 1942, pages 42-44.

These tests, conducted with both units in operation under full load schedule, provided for connecting the wattmeters which normally record the outputs of both units to record rkva. in order that a continuous record of rkva. output could be obtained. The tests and results are discussed as follows in the order conducted:

Both Units Under Regulator Control

Operators were instructed not to make manual adjustments during test periods in either kw. or rkva. outputs except as will be referred to in the discussion.

Obviously, the best time to test the performance of the two units under their respective systems of voltage control is during periods of most rapid system load changes, consequently the period from 6:30 a.m. to 8:30 a.m., E.W.T., was selected.

Abrupt reduction (Fig. 1) in rkva. output from No. 2 unit (B) at 8:27 a.m. was accomplished manually, the operators having been previously instructed to reduce the output to approximately 15,000 rkva. should either unit reach 28,000 rkva. automatically and hold this loading for a few minutes.

Summarizing the performance of the two units during this period:

Period 6:30 a.m. 8:30 a.m.	Unit No. 1	No. 2
1. Unit load-kw.	63,000	66,000
2. Min. rkva. output	8,000	10,000
3. Max. rkva. output	10,000	29,000
4. Rkva. contributed to increasing load	2,000	19,000

Both Units Under Manual Control

At 8:35 a.m. both units were placed under manual control and operated in this manner until 9:35 a.m., *i.e.*, the voltage regulators were made inoperative. The units, as was to be expected, took no cognizance of varying rkva. requirements of the system and maintained a steady rkva. output. The behavior of the units under this method of operation, represented by Fig. 1 (C) and (D), is summarized below:

Period 8:35 a.m. 9:30 a.m.	Unit No. 1	No. 2
1. Unit load-kw.	63,000	66,000
2. Min. rkva. output	12,000	13,000
3. Max. rkva. output	13,000	14,000

At 9:35 a.m. No. 1 unit was placed under regulator control, while No. 2 unit was allowed to continue as in the previous test, under manual control. The performance of the two units is shown by Fig. 1 (C) and (D), 9:35 a.m. to 10:30 a.m. The kw. loading was as in the previous test.

Obviously, for all practical purposes, the rkva. output from No. 1 unit was not under automatic voltage regulator control because the plant voltage did not vary sufficiently to stray from the regulator dead-band, consequently the rkva. output remained constant, as did the output of No. 2 unit, which was under manual voltage control.

This test was concluded at 10:30 a.m., when the No. 2 unit regulator was returned to service. Fig. 1 (E) and (F) shows that No. 2 unit under continuous voltage supervision by the direct-acting regulator immediately began to supply rkva. to the system as required by the load, while the voltage regulator on No. 1 unit failed to recognize this demand until shortly after the noon hour load drop occurred.

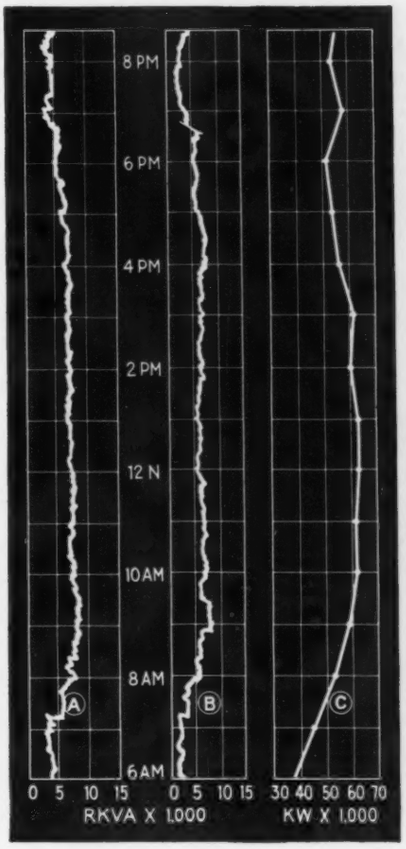


FIG. 2—Facsimile of Plant Arkwright rkva. output

(A) and (B) rkva. output of Nos. 1 and 2, 40,000-kw. units, respectively, August 6, 1942; (C) kw. load in the plant vicinity.

The question has been raised regarding the behavior of the Atkinson units if both were placed under continuous voltage control. Fortunately, more than an opinion regarding such operation can be expressed using Plant Arkwright as a criterion. Here both 40,000-kw. units have their rkva. outputs controlled, Fig. 2 by direct-acting voltage regulator systems, identical to the one installed with No. 2 unit at Plant Atkinson. Unlike the units at Atkinson under different types of control, the Arkwright units under similar controls share the burden equally.

During the period represented by Fig. 2 the average plant output was 84,000 kw. The regulators held the generator voltages without manual adjustment between the limits of 13.7 kv. and 13.8 kv.

Resemblance is noted between the trends of the local load and the rkva. outputs of the two units, indicating that the rkva. output of the units was being most effectively controlled.

Regulator Speed of Response

Faster response for the direct-acting type seems to be verified in Fig. 1 (A) and (B) where (a) and (b) represent the rkva. supplied by the two units into a distant line fault. Throughout the past lightning season it has been noticed that No. 2 unit consistently supplies more rkva. into system short circuits than does No. 1 unit, which is proof of higher speed response. None of the three turbo-generators in Georgia controlled by the direct-acting voltage regulator system have shown any tendency to lose synchronism during severe system disturbances, which speaks for the stability of the regulator system.

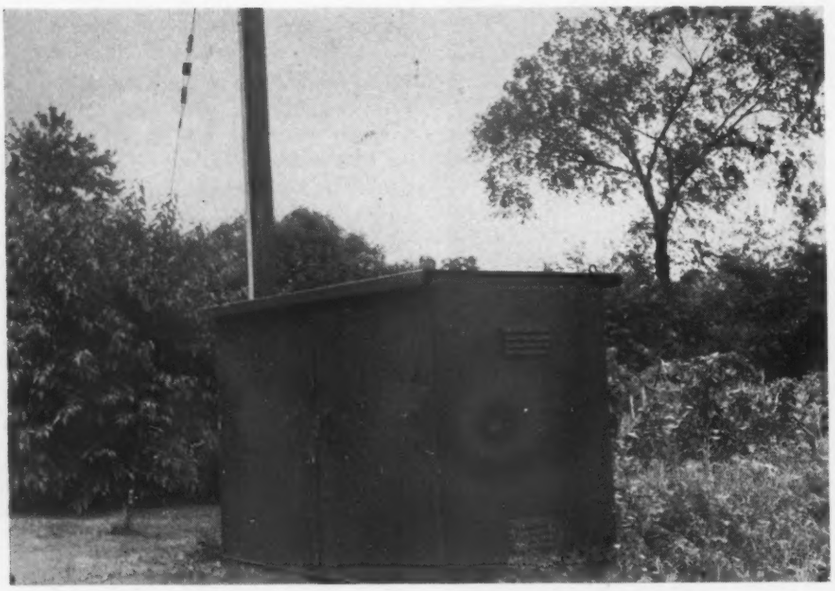
Turbo-generators as a Source of Rkva

The present trend seems to be toward the purchase of relatively high power factor turbo-generators and, usually, with prime mover large enough to produce full rated generator kva. in kw. This practice means that the power system must look elsewhere for its source of rkva. This article does not attempt to deal with the economies of such practices other than to point out that, where located reasonably close to the load, a little extra field strength with almost negligible increase in copper sizes in turbo-generators offers rather low cost corrective capacity. Continuous control of rkva. capacity, whether it be in a turbo-generator or synchronous condenser, is essential for the most effective utilization of available rkva. by the power system.

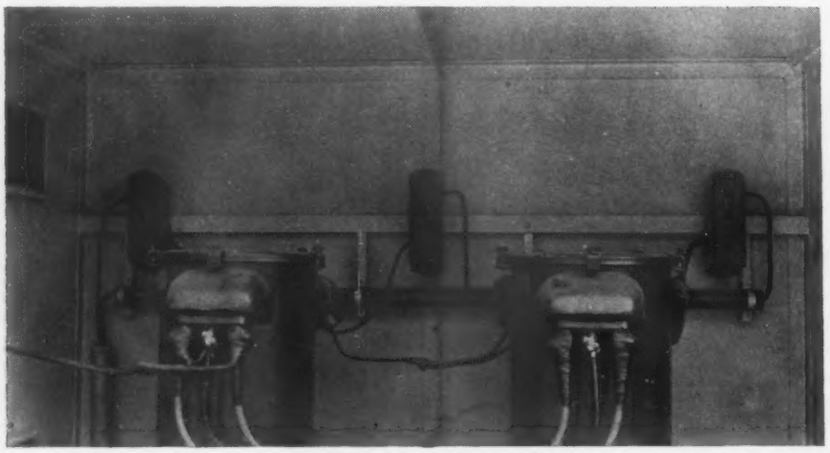
Transformer Housings Superior to Platforms

Over-all economy is found in portable steel house set on a concrete mat to shelter up to three 100-kva. pole-type transformers — Also has sabotage merits

G. H. LANDIS, Electric Distribution Manager, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.



TRANSFORMER HOUSING of size sufficient to house three 100-kva. standard overhead distribution transformers has served as an ideal means of using subway transformers salvaged from underground systems which were converted to network operation



FRONT DOORS removed on installation of two 37½-kva. transformers where load growth indicated necessity of larger transformers in the near future. Cutouts mounted on rear wall are easily accessible. This installation serves single-phase overhead residential load and a three-phase municipal sewage pumping plant

TIME-HONORED PRACTICE followed by practically all utilities for supplying medium-sized power loads from the distribution system has been to install transformer platform structures on the street or property adjacent to the prospective load. Although adequately serving the purpose for which it was erected, the transformer platform type of structure has the following disadvantages:

(a) It should preferably not be used along streets or in neighborhoods where its appearance may have an undesirable effect on the company's public relations.

(b) It is a hand-made assembly job, requiring the use of the most expensive type of labor, working with minimum efficiency, in hazardous positions.

(c) Any maintenance work requires the continued use of linemen, since no equipment can be reached without climbing the structure.

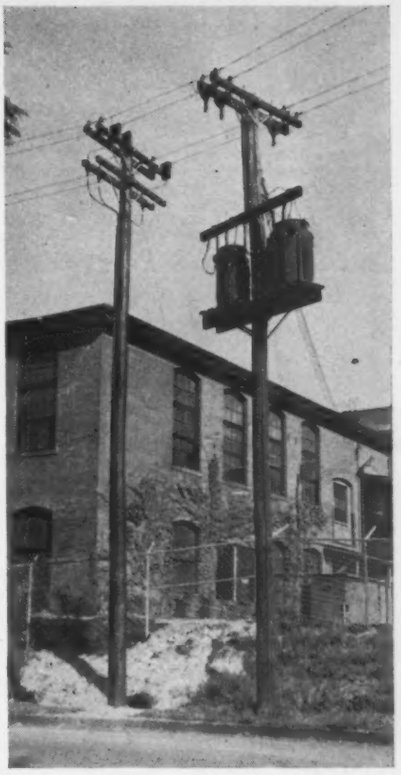
(d) Exposed live wires, in addition to being unsightly, afford additional hazard.

(e) It is costly to remove, if the power customer discontinues use, and has little salvageable value.

Some two years ago the Central Hudson Gas & Electric Corporation developed a steel housing for installing these medium-sized power banks which has met with favor by the operating group, the customer and the public. Although using steel, and therefore not at present applicable for general use during the war period, it has met with favor of governmental agencies responsible for the protection of vital war industries, where the inconspicuous installation, with its added protection against possible sabotage, has decided advantage over the conventional platform structure.

A typical installation is shown in an accompanying illustration, a unit containing three 75-kva. transformers.

An installation of two 37½-kva. transformers with the front doors removed for access to transformers and wiring (also shown) demonstrates the ease with which the unit may be installed, inspected and maintained without the use of climbing equipment or trained linemen. The details of construction (see accompanying illustration) shows the size of the unit, which is large enough to house three conventional 100-kva. pole type transformers.



A FACTORY expanded for war production, requiring considerable increase in transformer capacity, provided possibilities for use of steel housing with greater protection. Compare the exposure of the old pole installation with the new steel housing in the background

Portable Construction

The house, of welded construction and of a design of such simplicity that it can be made up in the company shop or in any local steel fabricating shop, is made up of 16 gage sheet steel welded on a light angle frame. Lifting hooks on each corner of the roof allow the entire unit to be swung into position on a previously prepared concrete mat by means of any line truck derrick. Transformers are spotted in place on the foundation before the housing is swung into position over them, thus eliminating any unnecessary handling of transformers.

Design of the house is such that any transformer can be removed or replaced without disturbing the house. The bottom of the house is secured to the foundation by means of anchor bolts and clips which do not require careful alignment for securing the house. Ventilation is provided through screened louvers on both sides of the house. The removable front is built in sections for ease in handling and is hinged outward and easily removable by lifting off hooks; it can be locked in place.

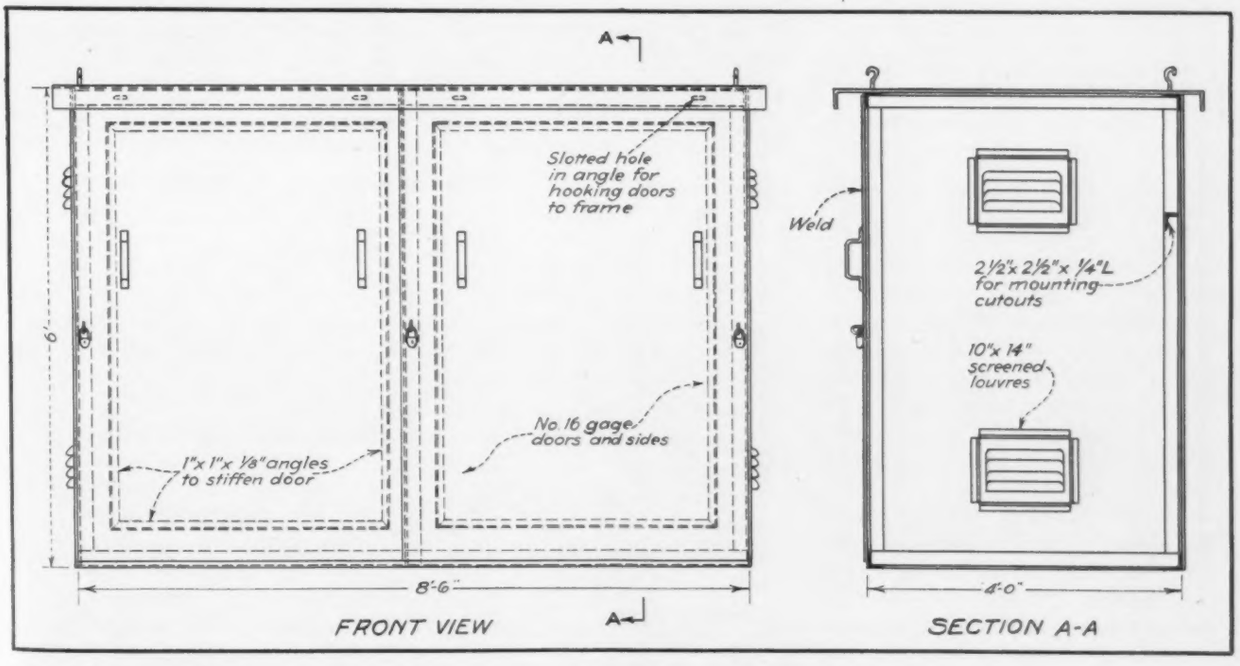
The concrete slab, 6 in. thick with light reinforcing mesh, can be either precast or cast in position, depending on local conditions. Where ready-mixed concrete is available the practice has been to cast the foundation in position, as the form work is extremely simple and can be reused.

Provision is made for the addition of a primary metering cabinet, when required, by bolting the cabinet on the rear of the housing.

Primary supply lines are brought into the unit through insulated cables underground from a riser on the primary pole. Rubber compound insulation eliminates any necessity for potheads on the primary cables. Cutouts for fusing the transformer may be installed either on the pole or inside the housing, where provision for mounting the cutouts is made by means of a horizontal angle behind the transformer primary bushings.

Over-all Economy

Assuming that the transformer housing is to be placed on the customer's property where no existing pole is available for the structure, a



STEEL TRANSFORMER HOUSE has 2½x2½x¼-in. frame angles. Middle frame angle is bolted to allow removal of middle transformer

comparison of the approximate cost of the structure, including all labor and materials, is as follows:

	Platform Structure	Steel Housing
Structural (including poles)	$190	$226
Foundation	....	35
Electrical work (cutouts, arresters, primary wiring, transformer haulage)	185	124
Primary leads to transformer installation		
Overhead for platform structure	15	...
Underground for steel housing	....	97
Total installed cost	$390	$482

This comparison in initial costs, although unfavorable for the steel housing, would appear to be more nearly equal if savings in maintenance and operation are taken into account in determining the annual cost of operation. The advantage in appearance, safety and probable permanence of the installation are also in favor of the steel housing. In the event of removal, due to load changes or discontinuance of customer's usage, the use of the steel housing shows a decided advantage over the platform structure due to the high salvage obtainable in the former installation. Estimated salvage for the steel housing of $292, as compared to $104 for the platform structure, indicates a net saving of approximately $100 in the total cost of the steel housing installation.

•

Cable Grips for Service Drops

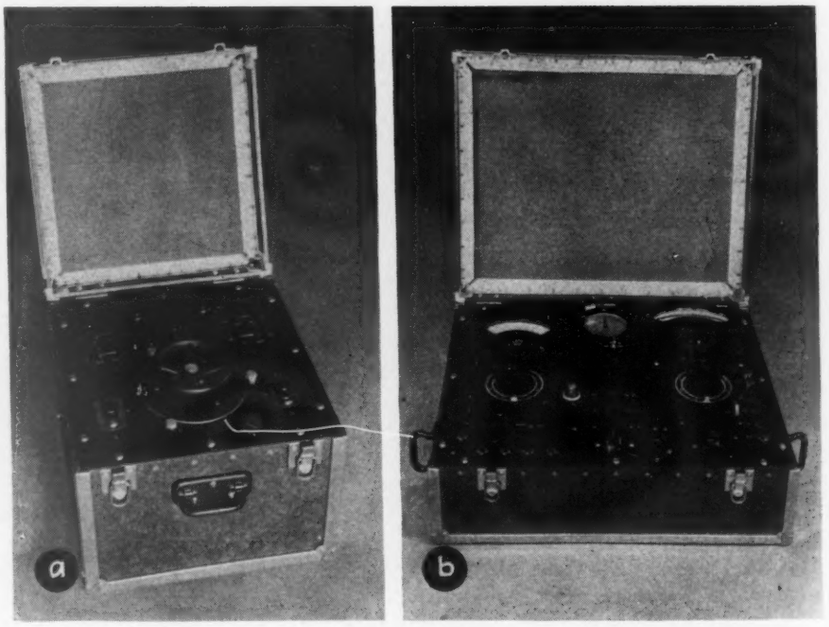
By W. E. SMITH
Superintendent of Distribution
Electric Department, Rockville Center, N. Y.

Three-wire No. 6 cables with uninsulated neutral (covered with braid) are regularly used for service wires on the Rockville Center system. These cables are held at the pole and at the house end by means of Kellems grips. At the house the grip is attached to an insulator, but at the pole to a simple lag-eye or hook. No trouble has been experienced with chafing of insulation or fatigue breaks because the flexibility of the grips (as contrasted with channel-and-wedge grips) seems to absorb all the vibration and swing of conductors. When a pole is replaced the slack in the drip-loops at each grip is available to reduce tension so that the bracket on the house is not pulled loose by the old pole when it is sawed off at the ground line and lashed to the new pole set after the old butt is pulled out.

Improved Design for Relay Test Set

Improved relay test set uses air core reactors to improve wave form and produce results identical with test means using resistance loading

B. J. BORTELL, J. E. KOZLOWSKY,* Central Illinois Light Co., Peoria*



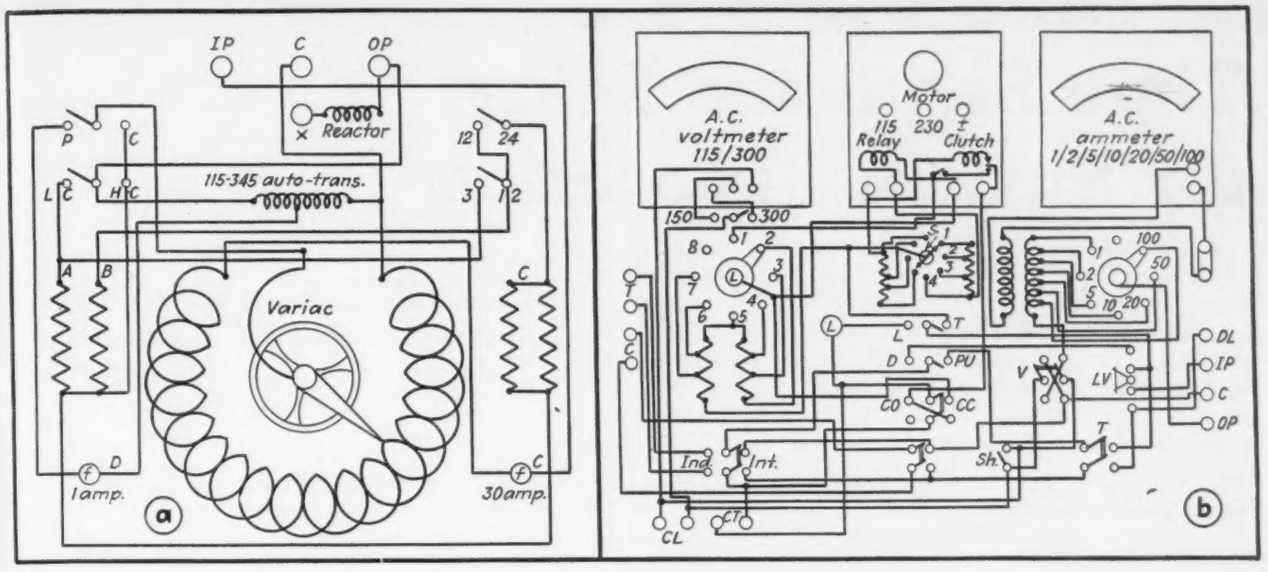
COMPACT two-part relay test equipment consists of (a) relay loading device and (b) relay test set

AN IMPROVED relay testing set has been built by the testing department of the Central Illinois Light Company at Peoria, Ill. The set was developed to eliminate time lost in connecting individual instruments and loading devices, to provide better protection for test equipment, to enable relays to be tested at current values up to 100 amp. without excessive drain on limited station test facilities and to provide more convenient control of test circuits, resulting in more rapid and more accurate testing. The set is suitable for testing 95 percent of the relays on this particular system without the use of additional equipment.

*Testing department.

Air Core Reactor

Among the outstanding features is the use of air core reactors which were fabricated to improve wave form and to produce the same results as if the relays were tested by means of resistance loading. These reactors have an inductance of about 0.001482 henries and were made by winding seven layers of No. 13 B&S gage wire.



CIRCUIT diagrams

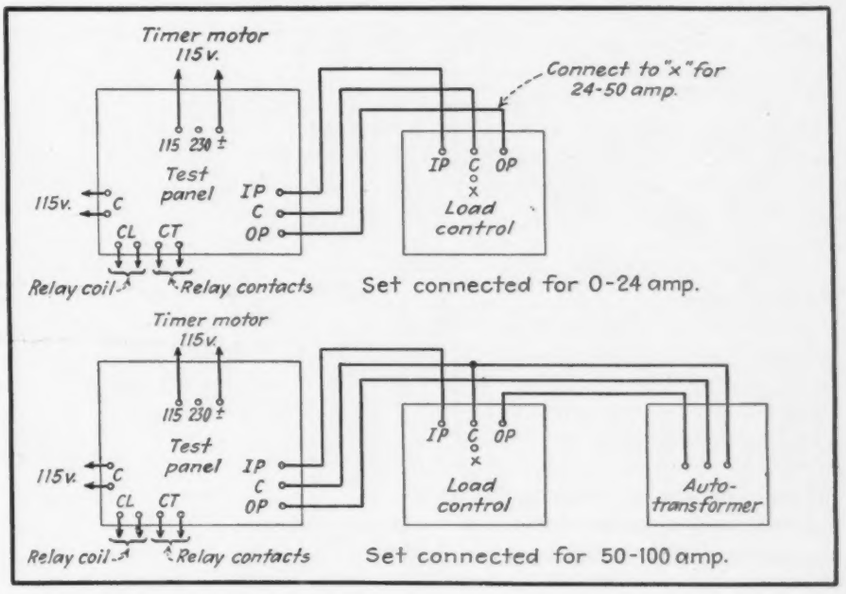
(a) Loading device. A is one 35-ohm; B is three 35-ohm in parallel; C is four 35-ohm in parallel.

(b) Test set. On this diagram positions of switch "L" for target operations are:

	48 v.	125 v.	250 v.
1	Lock	Lock	Lock
2	0.04	0.1	0.2
3	0.08	0.2	0.4
4	0.21	0.55	1.1
5	1.90	5.0	10.0
6	4.00	10.0	20.0
7	10.00	27.5	

Positions of switch "S" timer selector:

4	110 v. a.c.
3	48 v. d.c.
2	125 v. d.c. or 220 v. a.c.
1	250 v. d.c.



SET CONNECTIONS for 0 to 100 amp.

42 turns per layer, with a $1\frac{1}{4}$-in. air core.

A multi-ratio current transformer simplifies the taking of ammeter readings and permits the selection of the most convenient range with ease and rapidity.

A.C. or D.C. Tests

The relay trip circuit loading feature permits testing and adjusting of relay targets and contactors on either a.c. or d.c. independently of oil circuit breaker trip circuits.

Several months experience with the set has shown it to be not only very satisfactory but useful in determining relay performance at high multiples of pick-up in the field under conditions which had, necessarily, been left to assumption in the past.

Relay Class	Test Panel											Load Control Unit			
	M	T	LV	V	CO	CC	DO	PU	L	T	IND.	INT.	P	C	HC	LC
Over load. Contact opening.	X	①	X	X	X			X		X				X	○	○
Over load. Contact closing.	X	①	X	X		X		X		X				X	○	○
Under voltage. Contact closing on under voltage.	X	X	②	X		X	X						X		-	-
Over voltage. Contact closing on over voltage.	X	②	X	X		X		X		X			X		-	-
* Over voltage. Double contact timing switch OO.	X	X	②	X	X		X			X			X		-	-
Over voltage. Double contact timing switch PU.	X	②	X	X		X		X		X			X		-	-
# Impedance relay.	X	②③	X	M		X		X		X				X	○	○
# Differential relay.	X	②③	X	M		X		X		X				X	○	○

Switch Designation for Proper Circuit Set-up.
Σ Switches closed for set-up.
○ Switch closed for operation.
M Reversing switch. Forward is normal position. Polarity is as indicated on print.
* Over voltage relay with double contacts stationary contacts connected common for test.
# Additional loading equipment needed. (See schematic)
# Additional equipment needed for potential circuit. (Phase shifter - "Varistor" - Voltmeter)

Switch Position Marking on Panel.
M - Main Switch
LV - Low volts (Forward to close)
T - Test control switch.
V - Reversing switch.
CO - Contact opening.
CC - Contact closing.
Ind.- Independent timer source.
Int.- Internal counter source.
P - Potential.
C - Current.
HC - High current (Range 24-50 Amps.)
LC - Low current (Range 0-24 Amps.)

TABLE of switch positions for relay testing

Time Sequence Relay for System Separation

Design, development and application of a short-time out-of-step relay which is suitable for providing system separation upon the occurrence of long-period oscillations

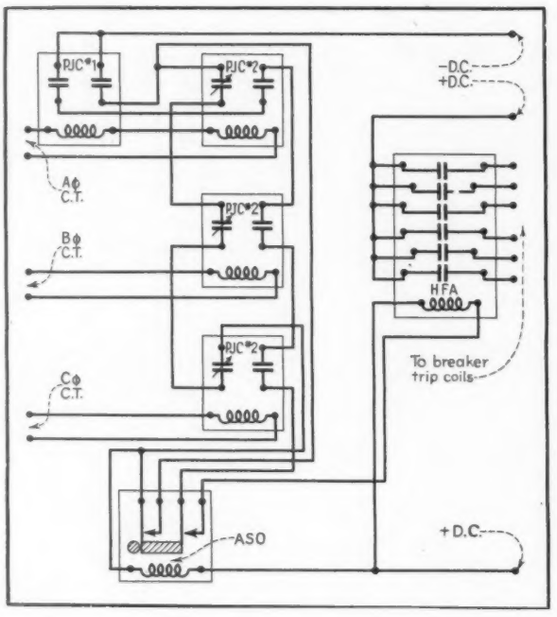
CHARLES L. BETTS, Jr., Relay Engineer, Westchester Lighting Company, Mount Vernon, N. Y.†*

IN ORDER to guard against an out-of-step condition between two systems, a relay scheme has been designed which provides definite separation at predetermined locations, based on the following three points:

1. Reliable and adequate supply to all substations under an out-of-step condition.
2. Continuity of service to high-tension networks.
3. Maximum current arising from an out-of-step condition.

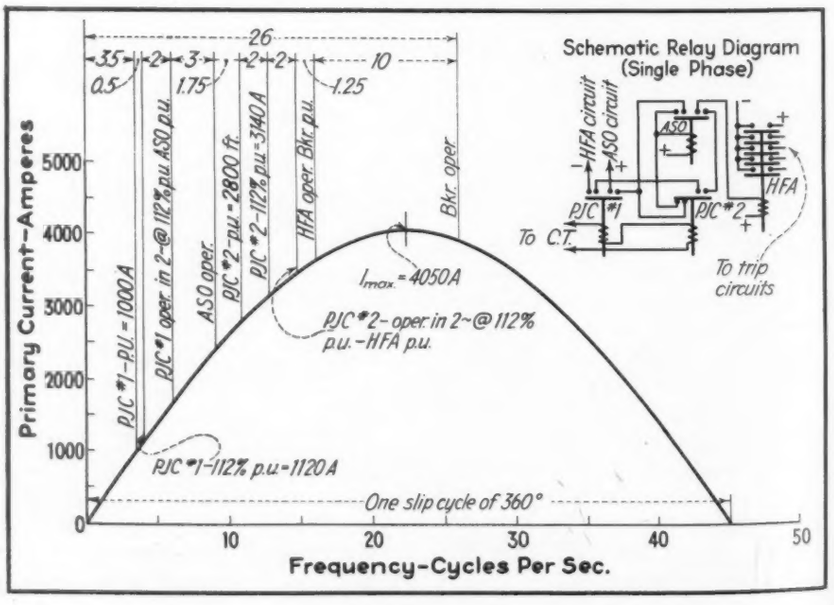
The need for providing some means of out-of-step protection on the Westchester Lighting Company's system was realized several years ago. This system supplies the main tie link between the Consolidated Edison Company and the Niagara-Hudson Corporation for interchanging power over two parallel 132-kv. transmission feeders which are tapped at three substations to furnish the main source of supply to Westchester County. In addition to the three high-tension substations, there are twelve others, all interconnected by low-voltage (13-kv. and 45-kv.) tie feeders.

Although there were no actual oscillograms available for out-of-step conditions on the Westchester System, it was assumed that swing oscillations would be rather slow, probably not faster than ¾ second. This is a "long-period oscillation" compared to the relatively short time required for three-phase fault current



SCHEMATIC wiring diagram, three-phase sequence relay

The most satisfactory settings for the individual units on a particular application were: PJC No. 1, 1,000 primary amperes pick-up; PJC No. 2, 2,800 primary amperes pick-up; ASO, 3 cycles (0.05 sec.) delay; HFA, 1.25 cycles (0.02083 sec.).



GRAPHIC ANALYSIS of operation of sequence relay for out-of-step condition. Full slip cycle of 360 deg. takes place in 45 current cycles. Small schematic diagram in upper right illustrates the functioning

*Condensation of E.E.I. paper awarded second of three James H. McGraw prizes for "most meritorious paper on any engineering or technical subject relating to the electric light and power industry."

†Formerly, now connected with the Sperry Gyroscope Company, Inc., Brooklyn, N. Y.

to reach its maximum value. A ¾-second period of oscillation for an out-of-step condition was considered reasonable and conservative in view of the size of the generating capacities connected at each end.

Time Sequence Relay

Advantage is taken of the difference in the "rate of rise" of current magnitude in order to distinguish between an out-of-step condition and a three-phase fault. In order for a relay to be able to differentiate between these two contingencies, the development of such a protective device was based on differing sequences of events occurring in the component parts comprising the complete relay, occasioned by these "rates of rise" of current magnitude. This complete relay, made up of several types of individual relays, or units, is called a "time-sequence relay," consisting of the following items:

1. On A-phase only—High-speed plunger type relay, set to pick up at a current value approximately 100 primary amperes above the maximum load current supplied by feeders to which it is connected. Specifications: General Electric, type PJC, two circuit contacts, both normally open. Designation: PJC No. 1.
2. On A, B and C phases—High-speed plunger type relay, set to pick up at a current value between two and three times that of PJC No. 1 (limit 85 percent max. out-of-step current). Specification: General Electric, type PJC, two circuit contacts, one normally open and one normally closed. Designation: PJC No. 2.
3. D.c. Time Delay—Plunger type relay, set to operate in 3 cycles. Specification: American Electric, type ASO, two circuit contacts, both normally open. Designation: ASO.
4. D.c. Auxiliary—Clapper type, high-speed relay. Specification: General Electric, type HFA, providing sufficient circuit contacts to trip designated breakers. Designation: HFA.

Sequence Relay for Out-of-Step

The curve for the out-of-step current was based on a maximum current of 4,050 primary amperes and shows how this current rises from zero to this value in 22.5 cycles, and then decreases to zero in a total time of 45 cycles. It also shows how the increasing current affects each individual unit of the sequence relay, so that all will have operated in 16 current cycles from the start of the out-of-step condition. System separation will have been completed as soon as the circuit breakers have opened. This will require approximately 10 additional cycles, giving a total elapsed time of 26 cycles from the start of the out-of-step condition until system separation has taken place.

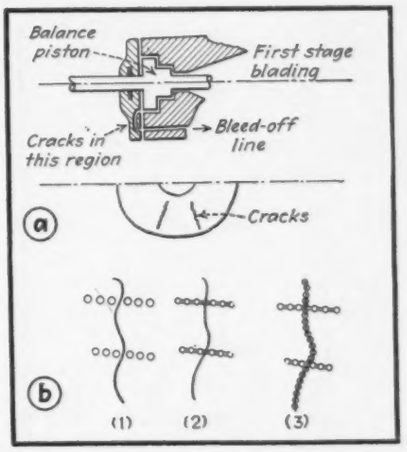
By means of a d.c. calculating board set-up of the system, it was possible to determine that the three-phase fault current, on the feeder to which the sequence relay would be connected, would amount to 2,850 primary amperes. As the PJC No. 1 was set to pick up at 1000 amperes, it will receive 2,850/1,000 × 100 percent, or 285 percent pick-up current, requiring approximately 0.75 cycle to operate. As soon as the PJC No. 1 has operated, the ASO will be energized, provided the PJC No. 2 remains de-energized, but the ASO will not operate until an interval of 3 cycles has elapsed. However, the PJC No. 2 was set to pick up at 2,800 amperes, and as it will receive a value of 2,850 amperes within 0.75 cycle after the origin of fault, the PJC No. 2 will start to pick up without any intervening time delay, thereby opening the operating circuit to the ASO. As the tripping contacts of the PJC No. 1, PJC No. 2 and ASO are all connected in series, it is evident that this circuit will not be completed to the HFA (auxiliary tripping relay) inasmuch as the ASO did not have sufficient time to operate.

Cracked Casting Permanently Repaired

Cracks in a large and expensive turbine casting—one that certainly could not have been replaced immediately under wartime restrictions—were permanently repaired at the Dubuque, Iowa, generating station of the Interstate Power Company recently by the patented Metalock* process.

As shown in the accompanying diagram, the cracks, two in number, were in the cast-iron head over the balancer piston at the high-pressure end of a 10,000-kw. steam turbine operating on steam at 250 lb. psi. and 550 deg. F. The cracks occurred over bleed-off passages in the casting where the metal thickness was reduced. While some 18 in. in length, they were not serious enough to leak more than slightly except under vacuum or slight pressure.

General procedure followed in making the repair was first to drill several holes, close together, on each side of the crack and in a line generally perpendicular to the axis of the crack. The metal between the holes was then chipped out to form a channel with fluted sides that intersected the crack at right angles. Several thicknesses of an evident soft alloy, having coefficient of expansion obviously less than that of the casting, were peened into the fluted channel, filling it completely. Next a series of overlapping holes were drilled and tapped in the casting along the crack and to a depth somewhat less than the thickness of the casting. Into these holes were threaded plugs of the alloy, which were then peened over, completely covering and plugging the crack along its length.



UNIQUE REPAIR restores cracked turbine casting to use. (a) Location of crack. (b) Steps in repair

1. Drill holes in line across crack.
2. Chip out cast metal between holes and peen in alloy.
3. Drill and tap holes along crack thread in alloy plugs and peen over.

The turbine casting which was repaired in this manner has been in operation for several months at the Dubuque station and is said to have given no further signs of either leakage or further cracking. Furthermore, the repair, as described, has been inspected and approved by insurance authorities. Cost of the repair was estimated to be about 10 percent of the cost of a new casting.

*Property of the Metalock Casting Repair Service, Columbus, Ohio.

Utility Sells Customers' Abilities to Produce "Bits and Pieces"

Small town machine shops in Oregon and Washington are supplying parts for Liberty ships, thanks to the efforts of a power company sales organization

D. B. LEONARD, Commercial Manager Pacific Power & Light Company, Portland, Ore.

BACK behind the snow-capped Cascade mountains of Oregon and Washington, in inland communities where most of the streams won't float anything larger than a good-sized launch, more than a dozen small machine shops are building parts for the torrent of ships pouring out of the fabulous shipyards of the Pacific Northwest.

Measured by dollars, their total contracts jingle like small change in these days of astronomical finance. Their total poundage of output would be dwarfed by the weight of the deckhouse of a single Liberty ship. They're making just "bits and pieces," but there isn't a ship launched that can get along without some of the things their skill produces.

But because of these "bits and pieces" elderly but skilled machine operators who would hesitate to jump into the malestrom of the huge modern "defense plants" are getting their chance to do part of the gigantic war job. So are typical small business men whose homes and investments root them in their communities. So are their wives. So even are their children. So, equally important, are their machine tools.

An Agricultural Area

Before the "bits and pieces" plan got rolling it was a paradoxical situation, to say the least, that existed in these communities in the heavily agricultural area served by Pacific Power & Light Company. Manpower was draining away to the hurly-burly of war production in mushrooming coast cities, with consequent declines in business. Even mainstay agriculture and lumbering were short-handed at best. Subsidiary lines like small machine shops faced none too happy prospects. Priorities, shortages and curtailments harassed their purely civilian trade, while contracts for essential war work just didn't seem to materialize despite much emphatic talk about the absolute necessity of "sub-contracting" and putting every machine tool in the nation into war work. The prospect of complete idleness for these machines and their operators wasn't too remote.

MRS. E. L. JUELL operates a press drilling a valve body, showing that women have an active part in production of "bits and pieces"

In capsule form, it was a picture of the situation facing "small business" almost everywhere. And here it was, right in our own backyard, happening to our immediate friends.

Here it was, bluntly, threatening our own revenues.

In times of peace, a threatened loss of revenue was a challenge to be met by an aggressive sales campaign. Wartime didn't seem to us to have changed that formula—except that formerly we would have sold to our customers; now we had to help sell our customers and their abilities.

Customer's Facilities

But it was still selling, and that's the way we took it—as a challenge to prove the advisability of maintaining a basic sales organization despite the "sellers' market" and various bans against "selling" as such.

The first step, naturally, was to study the products, find out what we had to sell. So over their respective districts went the Pacific Power & Light commercial and industrial representatives, looking at their customers' premises through different eyes. Where once they thought in terms of demand and consumption, now they catalogued machine facilities and capacities.

Accustomed to the use of terms like kilowatts, amperes, single phase, three phase, and all the other language of the electric industry, it was like learning a new tongue. Gradually the term "turret lathe" took shape as a definite tool with a variety of possibilities in the work it can do. Slowly the tendency to look blankly at a machine and wonder if it was a planer or a drill press disappeared. Soon we had a list of the power tools

available in the small machine shops in the territory and were able to interpret it into quantities, sizes and speeds.

Bear in mind that the shops surveyed were the small ones, the little fellows, often family-operated or with the owner and one or two associates comprising the crew. They were general machine shops, auto repair shops, and in one instance a plant specializing in spray equipment for use in the famous orchards of the region. No concern was necessary over the few large plants in the territory, because they were able to obtain contracts with relative ease.

A Liaison Agent

But the experience of the little fellows had been different. A number of these owner-operators had endeavored to enlist the facilities of their shops in the war job. That had meant trips to the larger coast cities, much weary searching for the proper contacts, untangling of various contract complexities, red tape and delay that added up expense after expense. Working singly and on a purely individual basis, costs piled up until they more than matched the modest proceeds of any contract the owner-operator could have handled. Distance and a number of other factors made it illogical for these scattered small shops to operate on a group basis.

Somewhat confidently, these surveys of shop facilities in our territory were turned over to various government agencies and to various holders of contracts. The widespread discussion of need for machine tool capacity made it seem the natural step to take.

But nothing happened. No contracts appeared magically to put these shops into war work. The idea of using the facilities of these shops needed selling—and direct action.

So the sales organization adopted a new attack and actually became a liaison agent between the shops and the job to be done, wherever it could be found. The War Production Board field offices seemed the proper focal point at which to start, and from them was obtained a list of purchasing agents in war plants who might be interested.

Then the "doorbell punching" started, in person, by mail, by telephone. Mostly the purchasing agents listened politely—and then said No. They couldn't really be blamed, either. The program didn't fit their needs because the quantities possible from these individual shops were too small, chiefly. Apparently our starting point was farther out along the roots of the production tree.

More thought on the matter singled out the incredible shipbuilding industry of the Columbia-Willamette rivers area as the most likely outlet for the production of these shops. The unbelievable speed shown by these shipyards in launching ships in ten days, then in a fraction under three days, meant complete coordination along the production and supply end, each part on hand and ready when needed and in the quantity needed. It looked like the best bet, and it was.

The Break-Through

From the shipyards it was possible to obtain a list of their principal local suppliers. Then came more doorbell punching among these suppliers to ferret out new information: Where did they obtain plans and specifications, contracts, castings, and did they have need of additional capacity for machining parts?

Here again it was a pure case of plugging away. Name after name was checked off the list before the break-through came. Electric Steel Foundry Company in Portland saw the potential source of war material represented by these shops and indicated active interest. They had work that could be handled by these machines and they could use this extra production nicely. It boiled down to a case of workmanship and reasonable cost, with a few obstacles like the matter of inspection thrown in.

Back into the field went the company's liaison men to present Electric Steel's drawings and specifications for needed items to the shops in the territory. Bids followed, and then con-

PRODUCTION is a family affair in the Robinson machine shop at Goldenvale, Wash. Owner I. C. Robinson runs a lathe, while his wife shows the product to John S. Baily, utility representative, and son John oils a drill press (left). H. R. Pinkerton, manager of Auto Service Company, Yakima, Wash., points out the features of a part made in his shop to district manager R. B. Bragg and Harry McMurray of the power company (right). Picture on front cover shows Frank Langervall, owner of Zillah machine shop (Zillah is a town of around 800 population in Washington), explaining a tricky bit of machining to D. F. McCurrach and D. B. Leonard of Pacific Power & Light

tracts for small trial lots in lieu of submitted samples. The plan was under way.

Succeeding contracts have been larger and more diversified and new suppliers have entered the field to take advantage of this available machine capacity. "Bits and pieces" from these inland shops are flowing regularly into the production lines for which the nation is famous.

Because of the transportation cost involved—the machine shop generally pays the freight both on the rough casting he receives and on the product he finishes from it—the items adaptable to this program are literally "bits and pieces." They must require relatively large amounts of machine work in relation to their weight.

Many items of shipbuilding meet these requirements. For instance, there are valve parts in large number and variety. There are ship bolts and nuts, idler pulleys, throttle control levers, machine gun sights, to name just a few. But some of the items now in the shops in Pacific company territory are "bits" only by courtesy. For example, one firm is working on auxiliary steering wheels which weigh 125 lb. rough, while another has undertaken a trial order on capstans weighing nearly 1,500 lb.

A Reality

In faster and faster cadence, new ships are hitting the water, each complete with its "bits and pieces." That means a continued demand for the workmanship of these relatively obscure shops. They have become a real element of the war of production largely because, even though they weren't big enough to afford a "front office" and stenographic assistance, a friendly utility has helped them sell their wares. The company's industrial salesmen visualized a series of small war industries instead of closed doors and idle machines. This vision has become real.

War materials in greater quantities will help shorten the number of days of fighting before these small shops —and all of us—can return to the ways of peace. Meantime these shop operators are content in the knowledge that they are doing their part, just as representatives of Pacific Power & Light Company are proud that they know how to serve in war as well as in peace.

Uncovers Fluorescent Auxiliary Defects

Two-year analysis of fluorescent complaints in Detroit finds defective starters and ballasts and low-voltage operation the causes of 82 percent of cases

DARRELL W. DRURY, Lighting Engineer, Detroit Edison Co., Detroit

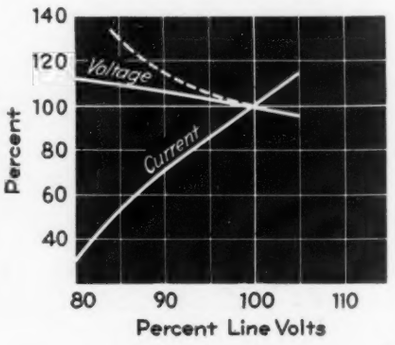
TWO YEARS of investigation into the causes of fluorescent lighting complaints by the Detroit Edison Company has revealed the existence of four serious needs which demand attention if the industry is to advance and provide a better service to the user. These are:

1. A competent consultation service to which the user may go with operation problems. (A recent survey by one lamp manufacturer showed that among 300 lighting utilities 84 percent had no test equipment for the purpose of analyzing fluorescent lamp operation.)
2. A better automatic lamp starter. Those of the contact resistance type have been found to have many advantages.
3. Auxiliary equipment designed for efficient operation at the lower line voltages—around 110 volts.
4. Some method of educating users as to the limitations of fluorescent lighting equipment and its proper maintenance.

The investigations leading to these conclusions were begun in July, 1940, and had two objectives: (1) To assist customers in obtaining the maximum utilization from electric service and (2) to contribute to the advancement of the art by making field experience available to the industry.

It had been forcibly brought to our attention that the users of fluorescent lighting equipment were unable to diagnose their own troubles and that once the equipment was installed there was no agency available with trained personnel and testing equipment to do this for them. Much of the onus in cases of trouble fell upon the shoulders of the utility industry under the mistaken belief that service was at fault.

It fell to the author to investigate the operating characteristics and problems in connection with the operation of fluorescent lamps and analyze complaints of unsatisfactory service. A study was made of the design and fabrication of lamp and auxiliary components of several manufacturers.



LOW LINE VOLTAGE boosts lamp voltage; improper ballast design (dotted line) aggravates the condition

In order to obtain the maximum light output from fluorescents, the currents, voltages and temperatures must be held within very close limits. To measure these factors in the field requires instruments of a range and sensitivity not generally available. It was found that the General Electric fluorescent lamp inspection kit is adequate for practically all complaint investigations and was used extensively.

In investigating complaints it was established practice to replace all defective materials identified at company expense. These materials were then sent to the Electrical Testing Laboratories, Inc., together with a report on the conditions under which they operated, for analysis of defects and suggestions for product improvement. The laboratory then had the opportunity to check our findings and discuss the problems with the manufacturer concerned.

During the period of this program a record has been kept of the nature and causes of the complaints received from customers. An analysis of this record, for 218 cases, is shown in tables I and II. Complaints listed in these tables were designated by installations and may involve many luminaires or just a few. The causes assigned in the table are our analysis of major sources of the difficulties complained of, although in some cases other factors contributed to the improper performance.

It is interesting to note that the nature of the complaint is seldom an indication of the real source of the trouble.

Defective starters and ballasts and low-voltage operation account for 82 percent of the complaints. The accompanying charts are presented to indicate some of the defects found and their resultant effect on performance.

Starter Defects

Contact Spacing Too Small—This causes "recycling" or repeated attempts of the lamp to start. It not only cuts down lamp life but causes excessive blackening due to deterioration of the cathodes or causes repeated starting.

Contact Erosion — This results when contact spacing is too small and may cause contacts to weld together, burning out the lamp filament or ballast. It also causes "gas cleanup."

Gas Cleanup—This is caused by "sputtering" of contacts. Material is tossed off from the electrodes which tends to absorb or "blanket" molecules of gas. The resulting deficiency of gas demands a higher line voltage to start the lamp. When this is not available lamp flicker or recycling results. Lamp failure usually follows.

Photo Sensitivity — Neon starter design generally requires some light impingement in order to function. Early starters that were totally inclosed often failed to operate for this reason. Some starters now have an aperture in the case which corrects this difficulty.

Gas Charge—A deficiency in the amount of gas originally placed in the starter. This, as with the case of gas cleanup above, demands a higher line voltage to start the lamp. Where gas charge is low, flicker and recycling result.

Condenser Failure—Failure of the condensers installed across the starter contacts short circuits the starter and results in failure of lamp or ballast or both.

Ballast Defects

Turn Ratio—Improper turn ratio in lamp ballasts can result in either high or low lamp voltage, ballast failure, starter failure, lamp flicker and low lamp life.

Broken Leads—Cause radio interference and failure of the lamp to operate.

Core Material—Deficiency of core material results in poor regulation and a reduction in light output from the lamp due to low lamp current.

Core Shape—Long, thin ballasts result in excessive flux leakage and poor regulation, especially on low line voltages. The result is low lamp current and low lumen output.

Loose Laminations — This is the most frequent cause of noise or hum.

Excessive Air Gap—Effect of excessive gap has the same effect on lamp operation as poor core shape. It results in excessive flux leakage and poor regulation reducing lamp current, light output and flicker.

Table I—Nature of Complaints

Short lamp life, percent	67
Overheating, percent	10
D.c. operation, percent	7
Noise, percent	5
Radio interference, percent	4
Flicker, percent	4
Color, percent	2
Miscellaneous, percent	1
Cases	218

Table II—Causes of Complaints

Defective starters, percent	47
Defective ballasts, percent	19
Low-voltage operation, percent	16
Frequent starting, percent	4
Defective lampholders, percent	3
Improper maintenance, percent	3
Defective lamps, percent	3
Missing components, percent	2
Improper wiring, percent	1
Miscellaneous, percent	2
Cases	218

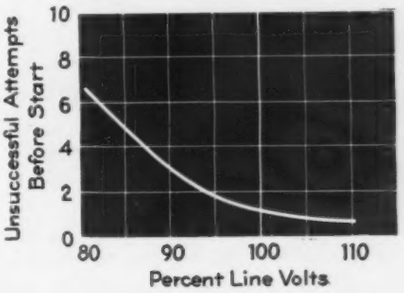
Lead Bushings—Sharp edges where leads emerge from reactor coil are frequent causes of short circuits and radio interference.

Condenser Failure — A frequent cause of ballast failure.

Loss of Sealing Compound—This condition is the result of excessive current and overheating of the ballast. It may be caused by incorrect ballast design or improper ventilation.

Line Voltage

Effect of low line voltage upon lamp voltage and current and upon starter performance is shown in the accompanying graphs. The solid lines on



TEST OF 40 glow starters shows effect of low line voltage on number of unsuccessful starting attempts

the chart indicate normal lamp current and voltage at line voltages frequently found. The broken line indicates the voltage supplied to lamp by some improperly designed ballasts. Note that at the low line voltages lamp voltage rises rapidly. This higher than normal lamp voltage results in recycling and lost-lamp life.

The result of a test of 40 new glow starters of the FS4 type is shown in the second chart. It will be noted that the increasing number of unsuccessful starting attempts at low line voltages increases abuse of lamp electrodes during the starting period. It also brings about sputtering of the starter electrodes and the starter ills resulting from gas cleanup, previously noted.

Wide experience during the Detroit investigations has revealed that line voltages below 112 are a very frequent cause of short lamp life due to repeated starting. There seems to be a need for a fluorescent lamp ballast that will operate satisfactorily on voltages of the order of 110 volts, especially in industrial plants that operate their own distribution.

Photo-Electric Test Table Facilitates Meter Checking

Short-handed meter departments can increase their test output by automatic stop and reset adaptation of well-coordinated control unit

T. OAKLEY, Superintendent of Meters, Illinois-Iowa Power Co., East St. Louis, Ill.

LOSS OF PERSONNEL in the meter department creates the problem of maintaining meters within the required accuracy limits with inexperienced testers. It is necessary to increase the efficiency of the meter shop and design for shop use equipment which will make the meter testing job easier and more pleasant for the meter tester. After a careful study of available automatic meter testing equipment, it was decided that the Photo-Electric Meter Tester results in faster testing and makes the operator's job less burdensome and more interesting.

The photo-electric tester was found to be the best suited for testing all types of single-phase meters of various manufacture. The test table (Fig. 1) incorporates the photo-electric tester to start and stop the rotating standard and eliminate the conventional potential switch used for manual testing.

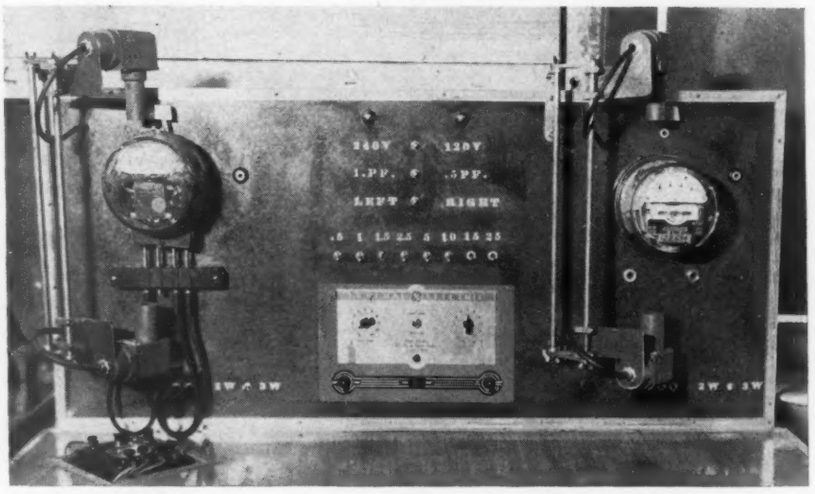


FIG. 1—Two-position photo electric test table has control chassis flush-mounted in the middle with load, voltage and power factor selector toggle switches above

Increased Testing Output

This new test table has considerably increased the number of meters tested, as compared with the old manual method, with a higher degree of accuracy by designing the test table to result in the following economies:

1. To make the test board adaptable to test either "A" type or socket type meters with a minimum of effort.
2. Since the photo-electric tester has practically no "repeating" error, it is not necessary to repeat the test run.
3. Number of revolutions of the service meter while under test was cut down from 20 to five revolutions at full load and one revolution at light load.
4. The double meter set-up (Fig. 1) enables the operator to utilize the running time of the meter to other useful work. The operator can be setting up, removing or writing the test reports on one meter while the test on the other meter is started and stopped by the tester.
5. Valuable time is saved by arranging the loading switches, the transfer switch, the power-factor switch and the potential switch on the board in a convenient place for the operator. Also, a swivel bracket arrangement for holding the light source and the photo-electric cell enables the operator to set up to test all types of meters with a minimum of effort.
6. Photo-electric test eliminates eyestrain and the human error on the part of the operator and makes the job easier, with increased efficiency, at a higher degree of accuracy.

Operation

The light source above the meter disk energizes the photo-electric cell beneath the disk through the anti-creep holes. The impulses (two per disk revolution) from the cell feed into the control unit and the rotating standard is started and stopped in accordance with the number of revolutions the operator selects for the service meter under test. Two selector switches are provided—one for full load and the other for light load, with

a toggle switch for throwing the control circuit from the full-load position to the light-load position.

With the service meter in position and the rotating standard reset to zero, the operator momentarily presses the start button and from that point on the test is automatic. Therefore, the operator can concentrate his attention to writing the test report and changing the other meter on the board.

After the service meter has run the selected number of revolutions the standard stops and the photo-electric control unit automatically resets to the starting position.

While the reset operation is being completed the operator can turn to the rotating standard, note the reading, make an adjustment on the meter, if necessary, reset the standard to zero and again start the test by simply pressing the start button.

Test Board Connection

Automatic reset is an improvement we incorporated into the photo-electric tester. It eliminates the use of the manual reset control as supplied by manufacturer, and furthermore acts as a signal to the operator to indicate the completion of the test run. It was necessary to add one external relay (Fig. 3) to the control unit to obtain this automatic resetting feature, which has proved very successful.

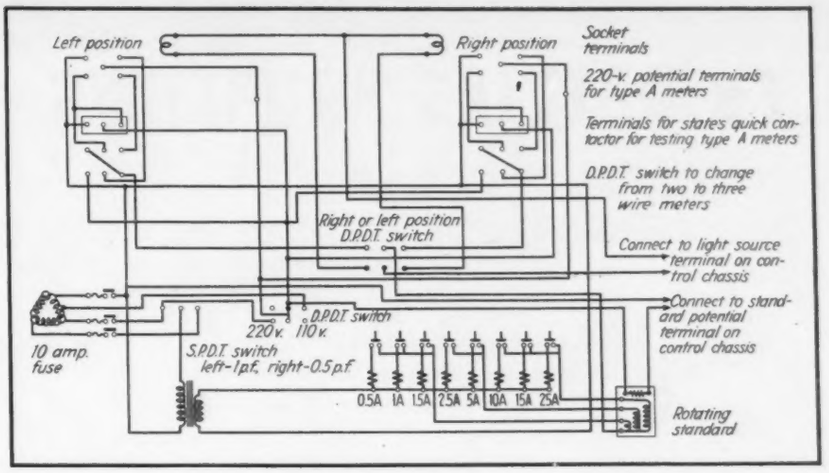

Left position
Right position
Socket terminals
220-v. potential terminals for type A meters
Terminals for state's quick contactor for testing type A meters
D.P.D.T. switch to change from two to three wire meters
Right or left position D.P.D.T. switch
Connect to light source terminal on control chassis
Connect to standard potential terminal on control chassis
D.P.D.T. switch
220v. 110v.
10 amp. fuse
S.P.D.T. switch left-1pf. right-0.5 p.f.
0.5A 1A 1.5A 2.5A 5A 10A 15A 25A
Rotating standard

FIG. 2—Wiring diagram of the meter test table for use of G.E. photo-electric tester

A two-pole, double-throw switch (Fig. 2) is used for changing the light source and the current connections from the left to the right position or vice versa. Toggle switches are used to select the load for the various meter ratings.

Current loading switches are permanently connected to the standard so that the proper standard current coil is in the circuit for each loading switch or combination of switches. A switch is also provided for changing from two-wire to three-wire meters.

The 0.5-, 1- and 1.5-amp. switches are connected to the 1-amp. coil of the standard and protected by a 2-amp. fuse. The 2½- and 5-amp. switches are connected to the 5-amp. standard coil and the 10-, 15- and 25-amp. switches are connected to the 25-amp. standard coil. As these loading switches are additive by groups, it is possible to test all ratings of meters up to and including 50 amp.

The 50 percent power-factor test is accomplished by the use of a single-pole, double-throw switch employing the cross-phase method.

A double-pole, double-throw switch is used to change the potential on the service meter and the rotating standard from 120 volts to 240 volts, or vice versa.

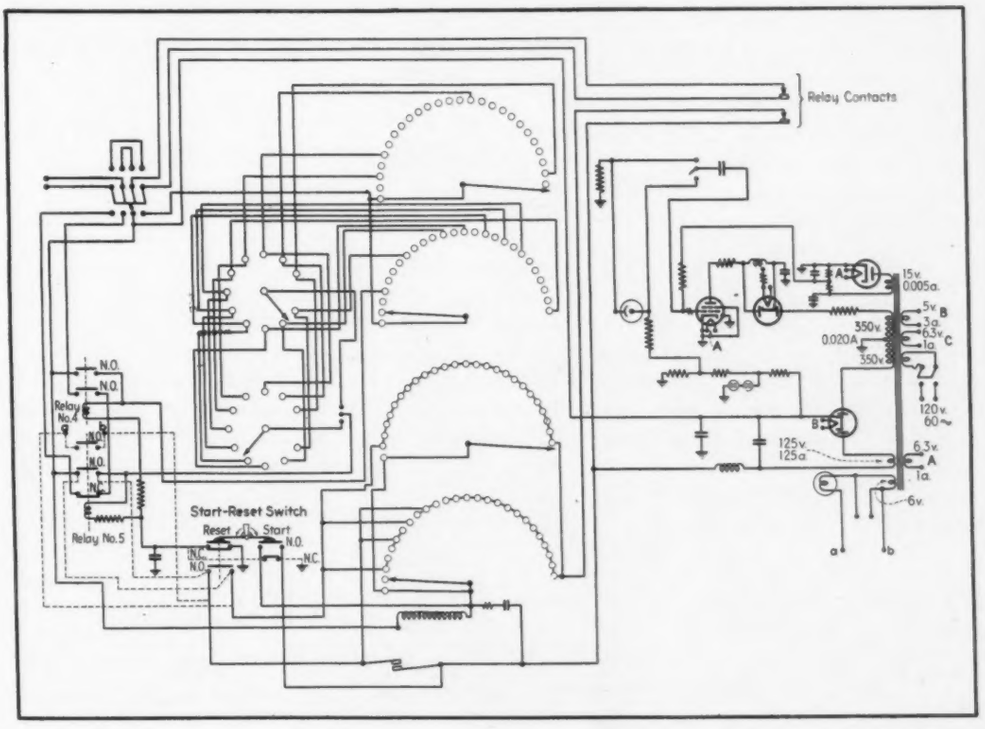


FIG. 3—Added relay resets to initial conditions as alternative to manual reset regularly provided

Changes made in manufacturer's wiring and connections of General Electric phototimer to provide for reset:

1. Disconnected normally open (NO) contacts on relay No. 5.
2. Disconnected normally open (NO) and normally closed (NC) contacts on the reset side of start-reset switch.
3. Added NO contacts (labeled a and b) to relay No. 5.
4. Added NC contact to start side of start-reset switch.
5. The supplementary connections are shown at the lower left in broken lines.

PRIORITIES PROBLEMS

Short Item Deliveries

Case No. 41

Because the limitation in Order P-46 on the amount of materials utilities may accept is calculated by classes of materials and is limited by the inventory in that class, utilities frequently find themselves unable to obtain essential quantities of certain maintenance and operating parts within the normal P-46 quotas (see case No. 25, ELECTRICAL WORLD, October 31, page 68).

Take the problem presented to WPB's Power Division recently by a utility which needed a supply of transformer fuses. The utility's inventory of all transmission and distribution materials, mostly in wire and cable, exceeded its inventory base so that no deliveries of materials in this class could normally be obtained on P-46 ratings. The company applied to WPB for authority to exceed its transmission and distribution quota in order to obtain the needed fuses.

The Power Division pointed out that paragraph F-4 (IV) of the order permits utilities, without appeal to Washington, to use P-46 ratings to obtain "short items" in any class of materials equal to 5 percent of total 1940 withdrawals in that class, regardless of inventory. This leeway proved adequate for the utility's fuse requirements, but later when the same company needed a supply of weatherproof wire the emergency provision did not provide sufficient margin. So application again was made to Washington for permission to exceed delivery quotas.

In granting the permission—there is no disposition on the part of the Power Division to deny utilities permission to exceed quotas where deliveries of short items are essential to operations—the division recommended that the company could save time and paper work by estimating its total requirements for short items quarterly and obtain a single authorization to exceed the limits for such materials, rather than request permission in individual cases as they arise. The procedure followed by a Southern utility in this respect illustrates the point. This company, like many others, found that its inventory of "other materials and supplies" precluded any new purchases, yet in this materials group are such items as gasoline, automotive repair parts, etc., which are not stocked in quantity.

The company sent in this report: 1940 inventory of other materials and supplies, $35,000; 1942 inventory, $45,000; permitted fourth quarter withdrawals (100 percent of comparable 1940 withdrawals), $100,000. Only $60,000 of this quota was considered essential, but because of an inventory which exceeds the base the company could accept no deliveries beyond the 5 percent emergency leeway provision. This totaled only $20,000. Inventory, while larger than in the base period, could provide only $5,000 more, so the company's request was for authorization to exceed the F-2 delivery quota by $35,000. This was granted on a blanket basis.

Using What's on Hand

Case No. 42

WPB's Power Division doesn't often like to see utilities substitute larger sizes of copper conductor on existing lines to handle overloads, but here's an exception to the rule.

The utility was faced with the problem of doubling the capacity of a 250,000-cir.mil conductor feeder line for a new war plant load about to come on the lines. Its first project application to Washington proposed installation of a second line of the same size, but 250,000-cir.mil cable is so difficult to obtain that WPB's Power Division inquired whether some alternative couldn't be worked out.

Back came the company's reply that it had a stock of 500,000-cir.mil cable and that it was possible to take out the existing line and replace it with the larger size. This alternative plan was quickly approved and, later, arrangements were made for the company to sell the 250,000-cir.mil wire which had been removed to another war job where no adequate substitute could be worked out.

Sectionalizing Substitutes for a Generator

Case No. 43

It's the method which uses the least amount of critical materials which gets WPB's approval, rather than the proposal which would be most satisfactory. A case involving a municipality's application for a 6,000-kw. generator illustrates the point.

The unit was stricken from the manufacturer's authorized delivery schedule when the WPB Power Division, last summer, cut down the volume of generator installations for 1943. The municipality needed only about half as much capacity, for the next couple of years, as it had ordered; the 6,000-kw. unit was a mate to the system's existing generating equipment and it was anticipated that the extra capacity would be absorbed within three or four years. But the WPB capacity expansion program allowed for no installations in anticipation of normal load growth several years ahead.

As an alternative, to take care of its immediately prospective requirements for additional energy, the municipality applied to WPB for authorization to build a 66-kv. interconnection with the neighboring utility so that it could purchase about 3,000 kw. for the duration. This involved construction of several miles of transmission line—through the city and in the company's territory to its nearest substation.

This proposal also was turned down by WPB in favor of a third plan which involved only construction of a line from the utility substation to the city line and blocking off of the municipality's load in the north

℞ **THE PROVISION in paragraph F-4 (III) of order P-46, as revised October 10, limiting replacement of meters to 60 percent of the 1940 rate, plus the number required for net new customers, applies only to consumers' meters—industrial and commercial as well as residential consumers. The limitation does not apply to utility meters in the power house, substation, etc. Maintenance replacement of these meters may still be carried on at the 1940 rate.**

side of town so that it would be served from the utility lines.

Consumers involved, of course, continue to be customers of the municipality and the city pays the utility for energy delivered into the sectionalized area just as it would have paid for energy purchased at its own substation. Cost of the line was borne by the utility.

Consumer Extensions in Line Relocations

Case No. 44

Order P-46 prohibits utilities from making any extensions of lines to consumer premises without specific authorization from WPB. This prohibition led one utility company recently to inquire about existing service extensions in instances where distribution lines were relocated.

The company's problem was this: It was moving a distribution line several feet as part of a city street relocation job and this would require an additional amount of line for each service extension involved. Was WPB approval of the additions to the service lines required or could this be done as part of the line relocation job which required no authorization because the amount of new materials involved did not exceed $500?

WPB's Power Division replied that no authorization was required, that the "stretching" of the service lines was part of the relocation and was not an extension of line to consumer premises within the meaning of Paragraph F-3(ii)(c) of Order P-46.

Central Warehouse

Case No. 45

A recent project priority application received by WPB's Power Division discloses how one utility is handling its inventory in excess of Order P-46 limits.

The company has leased an old idle warehouse and applied for priorities with which to obtain necessary materials to rehabilitate the structure. As justification for the project, the utility explained that it proposed to transfer, physically, all "surplus" inventory from the 40 stockrooms scattered over its system to the newly acquired stockroom. The central warehouse, then, would handle all requests from other utilities for needed equipment, and would be in a position as well to ship quickly to any part of the system any item which might get out of stock.

Under its present set-up, the company further explained, inventory in excess of P-46 limits was scattered and the job of keeping track of individual classes of material—either for P-46 reports or for inter-utility transactions and intra-company distribution—was found to be inadequate. Use of a card index system instead of a physical segregation of the "surplus" material was considered but found to be more expensive and to require more hard-to-get employees than the central warehouse plan.

After studying the unique application, the Power Division granted the required ratings for the rehabilitation project and the idea was passed along for these pages for whatever contribution it may make to other companies having similar problems.

Look First

Case No. 46

This case has its amusing aspects, but it's not the only one of its kind to happen and it illustrates a way that often will save time and trouble both for companies and WPB.

The company telegraphed the Power Division a request for an immediate rating high enough to permit a manufacturer to fabricate at once three 50-kva. transformers which had to be custom-built. Neither the frequency nor the size of the transformers was of standard design.

As is customary in such instances, WPB first checked its list of "surplus" stocks which utilities had offered for sale to other utilities. The list disclosed three transformers of identical specifications to those desired—on the "surplus" list of the same company which now wanted to buy new ones.

It was an oversight, of course, but a number of times WPB has found material on its "surplus" lists which is nearly enough identical to the equipment required that it could be adapted to use and thus avoid fabrication of critical raw materials. When this happens, WPB rejects the company's application for priorities for new equipment and proposes adaptation of the items in stock. The result is delay and additional paperwork.

Correcting Overloads

Case No. 47

Overloaded or low-voltage conditions on primary and secondary lines are not frozen in that state by Order P-46. Such situations can be remedied so long as not more than $500 worth of new materials are required and the changes do not include extensions to new consumers.

WPB's Power Division agreed, for instance, that Paragraph F-3(ii)(c) of P-46 permitted a company, without applying to Washington, to relieve an overloaded condition on a two-wire secondary by stringing a third No. 6 copper wire for 1,000 feet.

Nor is special permission necessary to change wire sizes. A utility which sought to correct an overload on a three-wire secondary by replacing No. 8 wire with No. 6 and installing another transformer was told to go ahead.

Erection of a new distribution line is acceptable under this section of P-46, as was determined in the case of another utility which sought to correct a low primary voltage condition by erecting a line several thousand feet long between substation and load center. A similar case was that in which it was proposed to relieve an overload on an overextended secondary by extending the primary 1,000 feet and installing another transformer.

In all four of these instances the factors determining that no prior approval was required were that not more than $500 worth of new materials were needed and no new customers were to be connected.

℞ UTILITIES NO LONGER need to obtain specific authorization from WPB's Power Division to install a third wire extension to homes with installed gas facilities which are rented without ranges where the new tenants bring along an electric range. Amendment to Order P-46-b provides blanket authorization to utilities to string such extensions. This eliminates the paperwork required by the procedure outlined in the Rx on these pages in the issue of December 12 (Page 70) and reverses the analysis of Case No. 24 (ELECTRICAL WORLD, October 31, page 68). Other requirements of P-46-b still hold; the extension can be made only where there is no other type of range available and where not more than 15 lb. of copper is required.

Editorials

S. B. WILLIAMS, *Editor*

WLB Ruling on Disputes Between Labor and Government

THE War Labor Board has said it, and it's greatly to its credit, that it has no jurisdiction in disputes between organized labor and local governments. Utility and public works employees of New York City, Newark, N. J., and Omaha, Neb., had asked WLB to intervene, but the board, after going through lots of motions, admitted that it could do nothing.

The position of organized labor in dealing with governments has never been strong. It might strike, but immediately public opinion rose up against it. It has none of the weapons of labor working for private companies, and now it has been told that the federal government can be of no assistance.

Cities and states are not purposely unfair to labor, but they are set up on an inflexible budget basis. Their income is fixed once a year and so must their expenses be fixed. Moreover, in working for a government, one is working for the people. They are the lawmakers. They cannot be forced to do what they are opposed to.

On the other hand, while some private employers may appear to be unfair, it is possible to negotiate with them and to have the decision stand. Employers can be forced to submit their differences to arbitration. Labor, in other words, has an opportunity when working for privately owned companies that it does not have when working for a government.

Years ago organized utility labor, represented then almost entirely by IBEW, was very much pro-public ownership. We have seen some indications, especially the AF of L action a few years ago in the Dakotas, that would lead us to believe that labor is not as rabid on that subject as it once was.

What effect the current decision of the War Labor Board will have on union policies we would not know, but it should open the way for some intelligent discussion between employers and union officials as to general economic and public policy. Labor and capital have now something in common that they can both see. Can they see it clearly enough to cause them to throw over past prejudices and to work together? If they do, they may find many other situations that would be benefited by joint action.

Jobs for Women

THERE ARE sixty occupations in the utility industry ordinarily held by men for which women are suitable, according to United States Employment Service (USES). As men for these jobs become scarce, women will be used, when and if available.

Most of the jobs listed are such that only a short training is necessary, and that is undoubtedly where most of the women will be employed. In the upper brackets, requiring two or more years of training, the need will probably not be so great because present job occupants are for the most part beyond the Army maximum age.

It has been proved in many war industries that women can do a very creditable job in heavy work, while for years it has been known that women are much more efficient in light assembly work.

Of course, it comes as a shock to be told of sixty occupations we had always thought as man's work listed as suitable for women, but on calm reflection we have to admit that there are a great many manual jobs that need no more skill than a steady hand, good eyes and a little common sense.

Heads I Win, Tails You Lose Policy

ALL THE TIME the Federal Power Commission has been issuing its book of rate comparisons, the utilities have been arguing to no avail that local conditions made it impossible to compare rates. Last week, however, at the Arkansas Power & Light aluminum rate negotiation hearing, counsel for FPC objected to any comparison with Ark-La Co-op rates on the grounds that different local conditions made it impossible to draw broad rate comparisons. The examiner upheld him.

Surely the Federal Power Commission can't expect to have a "heads I win, tails you lose" policy.

Pioneer to Pioneer

WHEN announcement was made last week that Crocker-Wheeler Electric Manufacturing Company had been sold to a large organization outside the electrical industry, we could not help saluting the corporate passing of a pioneer. Only six years after the beginning of central electric service Crocker and Wheeler, who had previously made C & C motors, the first standard line of motors, formed a partnership. For fifty-four years this organization, while small in comparison with some of its competitors, has been in the forefront of quality and the men who started the company were until their deaths among the leaders of engineering.

Nor is the least interesting element of the news the fact that this electrical pioneer is passing to a group the principal figure of which is today's most publicized war production pioneer—Henry J. Kaiser.

What to Do About Power-Factor Clauses

POWER-FACTOR penalty and bonus clauses have had a certain popularity in industrial rate structures, but, by their very nature, they never achieved much popularity with the rate payers. Now there is a movement afoot to have them ostracized, presumably by substituting direct charges for rented-and-returned kvars.

These power-factor clauses had an educational job to do and to a large extent they have done it by focussing attention on the evils of low power factor. But it is still doubtful if more than a handful of industrial managers will ever know what power factor is all about, or care. Industrial electrical engineers understand wattless current, but those who employ them and pay the power bills don't grasp it, even when the lowly parable of the froth on the beer is expounded to them. Although they have no difficulty understanding that there's relatively little nourishment in mere foam, even if it is good beer inflated around a lot of nothingness.

But, just the same, if the bartender made no charge whatever for the foam the imbiber would be getting an unfair advantage, especially if he collapsed the bubbles and sold the resulting liquid as good beer for good cash. That's about what the capacitor has done to the power-factor correction business. Steady decrease in cost has brought the price down to a point considerably below the investment in generating and transformation capacity similarly devoted to production of the reactive power which capacitors provide so neatly.

That's why the utilities will do well to watch the movement to see that, whether power-factor clauses are retained with readjusted values of debit and credit or the trend moves toward a kvar. basis of charging, the figures do not get based wholly on the cost of capacitors. There will still be many kva. of generation capacity in service and committed to kilovars and their higher unit cost cannot be wholly ignored just because the capacitor is capturing the spotlight.

Retroactive Rate Reductions to Defeat War Taxes

RETROACTIVE rate reductions are something new. Detroit urged the Michigan commission to return to the Detroit Edison consumers the taxes on excess profits. While that commission refused, the Arkansas commission has ruled that excess profits of Arkansas Power & Light should be returned to the customers retroactively. The case is now going through the courts.

Has a commission authority to order retroactive reductions? That is a point for the courts to decide.

There is, however, a broader question of public policy to be decided. Can local regulatory bodies set up orders which would drain off federal tax moneys? The draining-off process would apparently take the form of refunding the taxes pro rata to customers. Is it legal to refund federal taxes to customers in some cities and not everywhere?

The amount that might actually come out of the utility pockets is small indeed, but the principle is large. In addition to the broad public policies, there is the whole question of return. Can a commission order a reduction that will reduce the return below a reasonable margin? Is it any argument that taxes would produce the same result?

A rate reduction is such a permanent thing, while a tax rate can be changed at any time that it can be shown to be too restrictive. Thus it isn't the same thing either way to the utilities.

An unfavorable decision in the courts on this case would produce a field day for every commission—at the expense of the companies and the war effort.

Who Pays for Canceled Orders

IN THE PERIOD when utilities were expanding the capacity of their systems to carry the expected war load many special pieces of apparatus were ordered. Deliveries were long and orders were placed well ahead. Then came limitation orders and work on some of this equipment had to stop. Who is responsible for the cost?

If and when work can be resumed on this kind of manufacture it is probable that the need will have passed. The customer will admit that the order was placed in good faith, but that it was of no use unless it could be had at the agreed-upon delivery date. The manufacturer admits this, but says that he did not cancel the order; all he wants is the money he expended upon the order up to the time he was forced to discontinue work.

There is the possibility that a substantial part of the orders may be deferred until the need again arises, provided the regulatory bodies take a somewhat different attitude toward incidental costs in such a transaction than were taken by the Federal Power Commission in the State Line case. In that case the postponement of delivery was voluntary, while in the current cases it was an act of government under war authority. That might easily make a difference.

Of course, it should be obvious that none of this problem would have arisen had there been standard equipments and the orders placed therefor. What one customer could not have another with priorities could take and no one would lose.

If it is determined that the responsibility lies somewhere between the customer and the manufacturer—that is, if government refuses to have any part of the cost—then there ought to be some prior joint acceptance of adjustment principles. Is the cost assessable to the customer under such conditions, the whole cost, including overhead plus profit, or merely expended materials and labor, or somewhere between? It would seem that a uniform policy which had the blessing of regulation would cause the least amount of trouble.

Washington Comment

GEORGE E. DOYING, Jr., Washington Correspondent

Coming—A Ban on "Non-Essential" Lighting

WPB'S POWER DIVISION is about ready to recommend issuance of a War Production Board order extinguishing all decorative, display and similarly "non-essential" lighting throughout the United States for the duration.

The proposal will reach WPB's "topside" officials for a policy decision within a month, probably less, and a good bet for the effective date is about February 1, 1943. Administratively the plan can be put into operation on short notice, by utilizing the working experience gained in the Southeastern curtailment program of a year ago.

Three major factors, and perhaps a fourth, are converging to dictate inauguration of a "lights out" campaign at this time—fuel, generating and operating equipment maintenance, and ignorant criticism. And the last of these may actually be the most potent!

Not Power Shortage

These need to be taken up in order. But, first, before any attempt is made to justify the proposal, it is emphasized by the proponents that there is no element of generating capacity shortage in the picture. The program is to be represented as one of the wartime sacrifices of the utilities and this is to be stressed officially and repeatedly by WPB.

Fuel conservation is the most obvious and perhaps the most controversial aspect of this proposed "brownout"—to coin a word for it. Since Pearl Harbor, the word blackout which characterized the Southeastern program has developed a harsher meaning, and dimout, in the coastal regions, is associated with a distinctly different purpose and result.

It is essentially a measure to halt unnecessary use of fuel—and transportation—that a "brownout" is now coming to the fore. Not an emergency fuel rationing program because of any shortage of utility stocks, except in some instances where generators are gas or oil fired, because utility stocks of coal are at record peaks.

Really Unnecessary

Rather it is a plan for cutting down fuel consumption in line with WPB's overall policy of "stripping the fat" from the civilian economy by eliminating non-essentials all along the line. In this connection, it is worth noting that a nationwide "brownout" was seriously considered in the Power Division six months ago. It was dropped then both as unnecessary and because the WPB program for stripping other civilian industries down to bare bones was then hardly more than a goal in the study stage.

The "brownout" is still unnecessary in any real sense, but programs for cutting the frills out of many another orbit of civilian living are now just around the corner to add a somewhat indirect fourth "shoving" force. And the Power Division feels that there is no longer any reason to hold back a program estimated to save nearly two million tons of coal annually and smaller, but perhaps more significant, amounts of oil and gas.

An additional conservation feature supported by the Division is that the program will reduce the wear and tear on utility equipment with consequent savings in maintenance. Admittedly, this is hardly chartable in pounds of scarce materials, but it is argued that with equipment being pushed, generally, beyond ordinary operating levels whatever can be sliced off that "overload" represents net gain to the war effort.

These two—fuel and machine conservation—are the tangible dividends upon which WPB counts from a "brownout." Having its effect upon the situation, also, is the criticism being voiced of gay white ways and brilliant signs and display windows lighted by fuels which the government is urging the public to conserve. Curiously, perhaps, these jibes aren't coming from those whose solution would be more government hydro capacity. They are coming from those within the government who might be expected to realize that a saving of 2,000,000 tons of coal out of six hundred million tons of anticipated 1943 consumption is only a drop in the bucket. Also, from a not yet important, but growing, volume of comments from ordinary people whose homes are cold!

There isn't much reason to expect that WPB will attempt, in the face of its own civilian de-frilling program, to argue very long against this clamor.

Assuming that the "brownout" is to be, what will be its scope? The Power Division's plans have not yet been reduced to a formalized text but the Southeastern program is the pattern which is to be used. That order prohibited: Sign lighting, show-window lighting, outline and ornamental lighting, outdoor lighting, floodlighting or field lighting for amusements or sports, and interior or exterior lighting for decorative or advertising purposes. Exempt were "ordinary" street or traffic lighting, signal or other lighting for police, fire or other public safety departments, and war plant protective lighting.

No Modifications

There has been some discussion of relaxation to the extent of requiring only a dimming of store windows, theater marquees, etc. But no such modification is likely; it presents too many and too complicated administrative problems. A simpler, more workable rule is: Lights for public safety; no others.

What about the financial effect of a "brownout" upon utilities? The Power Division, frankly, hasn't officially inquired into this phase of the matter, and doesn't intend to do so. It's admitted that the kilowatt-hours which would be lost by the program are relatively high revenue-producing business, while off-setting savings would be limited to reduced outlay for fuel.

The financial aspect has, however, been broached informally by the division with several companies. The reactions have convinced the agency that the dollars and cents angle isn't serious enough to warrant more detailed inquiry.

NEWS OF THE WEEK

Southwest Power Pool Rate Hearing Opens

First test case of Federal Power Commission authority to review and renegotiate contracts for war power supply — Rates charged to Arkansas aluminum plant under inquiry

The twice-postponed and long-awaited Federal Power Commission hearing on the matter of rates charged by the Southwest power pool for electricity furnished the Lake Catherine aluminum plant got under way December 14 at Little Rock, Ark. The hearing is the first case in which the FPC is moving to carry out President Roosevelt's directive that the commission "oversee" all government contracts for war power supply and, where necessary, review and renegotiate existing contracts (ELECTRICAL WORLD, October 17, page 71; October 31, page 82).

Schedules Were Approved

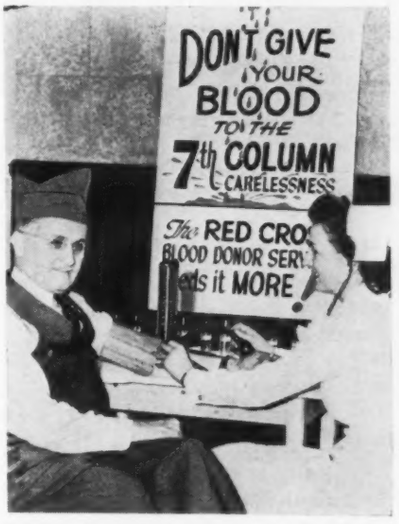
Present schedules for the Southwest power pool, involving eleven operating companies, were approved by the War Production Board and the Defense Plant Corporation. The original FPC order ordered the hearing to determine whether the rates in the pool contract were unreasonable. At that time the FPC jurisdiction was limited to companies engaged in interstate commerce. The President's directive of October 22, however, requiring the commission to investigate all rates paid by war plants, extended the FPC authority and, officials said, facts developed at the present hearing will have a definite bearing on the commission's similar actions in the future.

The present hearing concerns a contract the Southwest power pool signed on December 18, 1941, to deliver 65,000 kw. to the Lake Catherine aluminum plant on a basis of $2 per kw. demand plus 4 mills per kw.-hr. Just prior to the signing of the power pool contract the government-financed Ark-La Electric Cooperative, Inc., signed a contract to deliver 32,500 kw. to the Defense Plant Corporation from Oklahoma's Grand River Dam, at a slightly lower cost than the pool charges. Ark-La is not participating in the hearing, according to Thomas B. Fitzhugh, attorney for the cooperative.

At the opening session of the hearing Frank A. Hampton, chief trial examiner for the Federal Power Commission, rejected a prepared comparison of rates charged by Ark-La and the power pool, presented by Frank M. Wilkes, Southwestern Gas & Electric Co., and also excluded a prepared statement by Richard L. Arnold, Southwest Light & Power Co. attorney, representing the pool. He directed the pool to present "all the facts" without preliminaries.

Explaining the original contract signed between the DPC and the pool, Mr. Wilkes said it called for a payment of $130,000 a month for a minimum demand of 65,000 kw., plus 4 mills for each kw.-hr. used. The pool, as originally constituted, represented an investment of $4,934,000, he said. Later, he continued, WPB refused the pool authority to build connecting lines from Little Rock to Norfork Dam and Ozark Beach, Mo., and a tie-line to Riverton, Kan. This prevented the pool from bringing energy from Kansas Power & Light Co. and Nebraska Power Co., pool members, reducing invested capital to $3,181,000. To offset this, he said, the pool took over a $600,000 interest in a Southwestern Gas & Electric line from Weleetka, Okla., to Ashdown, Ark., and was using that to supply 35,000 kw. to the aluminum plant.

Later, the Defense Plant Corporation asked that the original contract be reduced to provide for a monthly payment of $80,000 instead of $130,000, Mr. Wilkes said, and a minimum demand of 40,000 kw. instead of 65,000 kw. with the contract terms extended from 16 to 24 months to assure the pool comparable gross earnings. The compromise was effected, he said.



BLOOD DONOR—Col. George Fiske, general manager of the General Electric Co., Kansas City, and chairman of the "Smash the 7th Column" drive, gives his blood to the Red Cross at the opening of the blood donor drive. Col. Fiske is head of the 3d Regiment, Missouri State Guard

C. S. Lynch Testifies

In the second day's hearing C. S. Lynch, executive vice-president of the Arkansas Power & Light Co., and chairman of the power pool's operating committee, testified that the pool would receive $4,474,139 from the DPC for supplying the aluminum plant with power for a two-year period. The utilities comprising the pool would actually

receive $4,074,139, he explained, after $300,000 had been deducted for expenses of the operating committee. A bill had been rendered DPC for the first three months, amounting to $550,000, he said, and had not yet been paid. He estimated that the participating companies would generate 755,618,000 kw.-hr. for the plant for which they would be paid at the rate of 5.39 mills per kw.-hr.

Earlier in his testimony Lynch traced, in great detail, operations of the pool over a "characteristic" week and described the complex control required. He was frequently interrupted by Lambert McAllister, FPC attorney, who protested that the evidence was "trivial."

On a second attempt by power pool attorneys to introduce evidence comparing the Ark-La rates with those of the power pool, the trial examiner reserved decision and copies of the prepared statements were attached to the record which, Hampton declared, "would enable a court review of the controversy."

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New York Facing Gas Fuel Shortage

Consolidated Edison Co. of New York sent a warning to several thousand of its large commercial gas customers last week to let them know that the company had little more than a week's reserve of oil available for the manufacture of gas, and that service would have to be curtailed unless stocks were replenished. They pointed out that a recent WPB directive held that industrial and commercial firms using more than 10,000 cubic feet of gas per month will be the first to have their supply cut off in the event gas companies were unable to maintain pressure on their lines.

Consolidated supplies more than 1,200,000 gas customers in Manhattan, the Bronx, and northern Queens. The Brooklyn Union Gas Co., second largest supplier in the city, sent notices to 8,300 commercial users reminding them of the WPB order.

Domestic gas customers were also asked to cut down on their use of the fuel for cooking, water heating and home heating purposes.

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Liquidation Completed

Officials of the West Memphis Power & Water Co., which sold its properties this year to a number of REA co-operatives and the city of West Memphis, have announced that they had completed liquidation of the company and have disbursed the funds.

NEWS BRIEFS

CLARKE COUNTY (WASH.) PUD was unanimously granted a 50-year franchise by county commissioners, meeting Dec. 11.

FOR THE THIRD successive year, East Palestine, Ohio's city council approved a proposal to grant domestic electric consumers free power for the month of December. Industrial consumers will pay only half their normal bills. The power plant is municipally owned.

PAUL REVERE, 28-year-old Westinghouse employee, and descendant of the famous early-American patriot, is carrying on the tradition of his name in true style. He was recently named to receive a WPB Award of Individual Production Merit, for an improved system that cuts valuable time in the manufacture of tungsten.

J. L. COOPER of Harrison, Ark., manager of Arkansas Power & Light Co.'s Ozark division, has rounded out 25 years continuous service with the company and will receive a gold emblem with five stars.

CHIEF ENGINEER H. H. COCHRANE reports that on November 17 the Montana Power Co. broke its all-time, 24-hour average with an output of 302,000 kw. Unusually good water conditions prevailed.

POSTCARD BILLING has been adopted by the Wisconsin Electric Power Co., Milwaukee, effective December 15. The change was made to conserve materials and relieve wartime manpower shortages, the company states. Bills were formerly delivered by company employees.

GOVERNOR-ELECT ORLAND S. LOOMIS, swept into office in the recent elections when the rest of the Progressive state ticket in Wisconsin was defeated, died recently, before taking office. As a city attorney at Mauston, Wis., Mr. Loomis started a battle with a utility company for lower rates, and from that time on took a leading part in rate cases. At one time he represented 25 Wisconsin municipalities in utility cases. As an assemblyman and state senator he took a lead in utility legislation and was active as a supporter of the Wisconsin "little TVA," sponsored by Governor LaFollette, who appointed him state director of rural electrification.

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C.E.O.C. Backing Treasury Drive

Utilities are getting behind the Treasury Department's year-end War Bond drive in "encouraging" fashion, according to first reports compiled by the Council of Electric Operating Companies.

The Council is cooperating with the Treasury in pushing the "Top That 10 percent by New Year's" drive which is aimed at obtaining pledges of at least 10 percent of each pay for War Bonds from 30,000,000 industrial workers.

Reports of the first two weeks of the November 15-December 31 drive showed that 100 utilities are averaging War Bond sales amounting to 5 percent of the gross weekly payroll. More than 60 companies reported 90 percent employee participation and eleven show 100 percent participation.

Best individual record yet reported is that of a mid-western company each of whose 1,200 employees is purchasing bonds. Sales total 15.4 percent of the gross payroll.

The council is extending its reporting service to give broader coverage of the industry's participation in the drive. Reports thus far indicate that "the industry is sincere and highly effective," a Treasury spokesman said.

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Appeal Sacramento Valuation Case

Both Pacific Gas & Electric Co. and the Sacramento Municipal Utility District have filed appeals for a rehearing with the California State Railroad Commission in the case setting a value upon the company's distribution system brought by the district (ELECTRICAL WORLD, December 5, page 9). The commission had set a price of $10,600,000 plus severance damages of $1,032,000 on the portion of the P. G. & E. system which the district is attempting to purchase.

If not granted by the commission, the petitions for a rehearing will place the matter in the hands of the courts.

Canada Building "World's Biggest Power Plant"

Installed capacity of "secret wartime development," built to serve aluminum plant, will be 1,020,000 hp., according to D. C. Howe, Minister of Munitions and Supply

Under the veil of wartime secrecy, a power development is being created in Canada which excels the much-publicized American achievement at Boulder Dam, the Hon. D. C. Howe, Minister of Munitions and Supply, disclosed in a recent public speech at the Dominion Commercial Travellers' Association.

Revealing that industrial expansion in the Dominion during the past three years of war could be expressed in terms of more than one billion dollars, Mr. Howe said that the great construction project to which he alluded must be nameless for the present, but would in due course be a source of pride to every Canadian citizen.

Confirms Development

Meantime, at Vancouver, B. C., George C. Bateman, Metals Controller, speaking before the western meeting of the Canadian Institute of Mining and Metallurgy, said that construction is now under way in Canada on a hydro-electric plant which will be "the largest single power plant in the world," and will compare with the 850,000-hp. plant on the Dneiper, developed by the Russians and since largely destroyed. Mr. Bateman said that the power plant was being built to serve an aluminum plant now under construction, which would be the largest single aluminum producing plant in the world, with a capacity exceeding the world production of aluminum in 1937.

In comparing the Canadian project with Boulder Dam, Mr. Howe said that similar methods had been employed, but there were factors on the site, such as extreme cold, snow, ice and heavy rains, which did not prevail in Arizona.

"The Canadian project also had to contend with a wartime shortage of labor and materials," he said, "and double the number of men were employed to rush the work through in time.

"Men had to be trained for the job, and an unusual amount of construction equipment had to be employed to maintain the schedule. At Boulder Dam the peak employment was 5,250 men, whereas in Canada the peak employment was 10,140 men. The United States government allowed the contractors at Boulder Dam seven years to complete the work, although the contract was actually completed in five years. In Canada the somewhat larger project will have been completed within 2½ years.

"As a matter of fact," he said, "the initial power was being used from the Canadian development within a period of 18 months from its commencement. The installed capacity of Boulder Dam, as of a year ago last January, was 975,000 hp., whereas the installed capacity of our Canadian development will be 1,020,000 hp."

Cites Aluminum Production

Amplifying his remarks on Canada's industrial expansion, Mr. Howe referred to the aluminum industry and asked whether many people realized that Canada was procuring 40 percent of the aluminum needs of the allied nations. The country's industry has grown seven-fold since the war, he said, producing today more than the whole world produced in 1939. The industry had been responsible itself for much of the electric power development, he added, pointing out that one-fifth of all the power generated in Canada was used to make aluminum.

Detroit Threatens Power Expansion

Having failed in its fight to obtain a rate reduction from the Detroit Edison Co., the city of Detroit last week threatened to expand its own power plant. The Public Lighting Commission of the city of Detroit operates a steam-electric generating station of 100,000 kva. capacity which supplies 161 circuit-miles of underground duct distribution in the city. The commission purchases about 4,000,000 kw.-hr. per year, according to the McGraw-Hill Central Station Directory.

The Michigan Public Service Commission recently rejected the city's request that the Detroit utility make a rebate of the $8,000,000 on which the Detroit Edison Co. will pay excess profits tax for this year's earnings. The commission ruled that it could not claim any jurisdiction over funds already accumulated by the Detroit Edison Co.

Apparently disgruntled over the failure of the commission to support the city's claim for a rate reduction, Mayor Jeffries said last week that an appropriation of $50,000 to survey the necessity for expansion and provide plans for equipment for the Public Lighting Commission would be proposed in the 1943-44 budget.

Asked if the survey contemplated sale of electricity in competition with the Detroit Edison Co. to industries and home owners (function permissible under the

SANGAMO'S "E"—Sangamo Electric Co., Springfield, Ill., held a celebration recently when it received the Army-Navy "E" award for excellence in war production. Left to right—D. S. Funk, president; Al Gillespie, assistant production manager; Roy Schleyhan, president of S.E.L.C.O., who received the award on behalf of the employees; Col. John T. Rhett, who presented the pins; Flossie Wilson, who received the pins on behalf of the women employees; Capt. Robert Henderson, U.S.N., who presented the pennant; Anna Hazel, A. E. Sandburg and Madelyn Calder, employees of Sangamo

city Charter), Mayor Jeffries' only answer was: "At least we wouldn't have to deal with the Public Service Commission."

Louis J. Schrenk, superintendent of the Public Lighting Commission, reported last week that the Public Lighting Commission was now operating above its capacity, exchanging power at peak-load periods under a contract with the Detroit Edison Co. Further demands probably will require expansion of present facilities or the purchase of more power from the Edison company, he said.

The $50,000 appropriation proposed, the Mayor explained, would be for plans and specifications for an additional transformer in addition to a survey of expansion requirements.

The Detroit Edison Co. has made no official comment on Mayor Jeffries' proposed study of the Detroit municipal plant expansion.

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Cost Per Kw.-Hr. Drops

The cost of electricity per kilowatt-hour to the domestic consumer in South Carolina has been reduced one-half during the last ten years, according to the state Public Service Commission. The cost has decreased from an average of 6.7 cents in 1931 to 3.099 cents in 1941. The average consumption for each South Carolina customer in 1941 was 1,234 kw.-hr.

Replacement Schedules Help on Drafted Workers

War Manpower Commission does not require validation as in case of Manning Tables and employers are protected pending final acceptance of formal plan

Replacement schedules are being advanced by the War Manpower Commission as the latest solution to the problem of drafting essential industrial and utility workers.

In general, replacement schedules are based on information compiled in preparation of a manning table (ELECTRICAL WORLD, November 14, page 85). They are designed to provide for systematic replacement of men who must be made available for military service.

Shortcutting much of the information required by a manning table, the replacement schedule protects employers pending acceptance of the formal plan. Replacement schedules need not be validated by WMC to become effective, as manning tables must. They go into effect immediately upon validation by the state selective service director concerned. Their use provides a means of forcing employers to prepare manning tables, which ultimately are expected to become mandatory anyway.

A replacement schedule consists of two parts. One is a replacement summary, which lists job titles and the number of workers employed at each. The other is a replacement list, in which draftable employes are listed by name in ascending order of deferment requests; *i.e.*, shortest deferments first, etc.

In preparing the replacement summary, employers must list job titles by plant departments or other operating units. Listed with each title is the number of women, non-draftable men and draftable men employed under it. The summary thus presents a condensed schedule of jobs and workers.

Only those men who actually will be replaced are carried on replacement lists. Each worker is listed by name and job title, year of birth, draft classification, draft board and order numbers and number of months before the employer will be prepared to replace him.

Influence of Training Time

Normally, those men who will be replaced first are those in occupations requiring the shortest training time. If a considerable number of men in a short-training job are to be replaced in a given month, however, their withdrawal may be spread over several months. Generally, also, the first to be replaced will be those who would first be available for duty were there no occupational complication. Single men should be listed ahead of equally replaceable married men. Similarly, where two or more men of equal or comparable replaceability are listed those with lower order numbers should be listed first.

After validation, a state acceptance number is assigned each schedule. Reproduced on Forms 42A or 42B, this number certifies that men so designated are part of an approved withdrawal program and should be treated as such.

Schedules are good for six months unless earlier revised. They must be renewed every six months, and renewals must be validated by state draft directors.

WON COMMENDATION—How air mail cuts down transmission time the world over and what microfilm V-letters accomplish in space saving featured a recent window display of Boston Edison which received appreciative comment from acting postmaster John W. Gleavy of Boston as "another chapter in the long series of contributions of Boston Edison to the public service". Photographs of this window were requested for the local files of the Post Office and the departmental archives at Boston

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City Plant Gives Bonus

Announcement has been made that the City Water and Light Department of Jonesboro, Ark., instead of sending out bills for December service, will pay an equivalent amount to each customer in war bonds and stamps.

Oppose Missouri Electric Sale to Cooperative

Fourteen utilities charge proposed transactions is initial move in substituting publicly owned and operated system in Arkansas and Missouri for existing utilities

The Missouri Public Service Commission has indicated that it would be "after the first of the year" before it hands down a ruling on the application of the Sho-Me Power Cooperative of Columbia, Mo., to purchase the 20-county power system of the Missouri Electric Power Co. for $2,500,000 in cash, to be financed through the Rural Electrification Administration. Fourteen utility companies are opposing the project as "the initial step in the purpose of creating in Missouri and Arkansas a vast publicly owned and publicly financed power project, to provide duplicative and competitive service in municipalities and territory already adequately served" by utilities.

See Approved Deal

Since the first REA announcement of the proposed sale of Missouri Electric (ELECTRICAL WORLD, July 4, page 7) application has been made by the parent company, Central States Power & Light Corp., a sub-holding unit in the Ogden Corp., for Securities and Exchange Commission approval of the transaction which was granted recently (ELECTRICAL WORLD, December 19, page 9) to enable the company to effect compliance with the provisions of Section 11 of the Holding Company Act.

The bitterness of the opposition to the proposed sale of the Missouri Electric Power Co. to a cooperative organized almost solely to acquire the property is evidenced by the presence of leading utility lawyers of the private companies at the hearings of the Public Service Commission.

Deal Involves $4,275,000

Sho-Me is an organization of 31 cooperative electrical companies, set up and financed through REA to distribute power to farm homes and rural communities. According to a recent dispatch in the Kansas City *Times* (December 5, 1942) it was organized solely for the purchase of Missouri Electric Power and has $130 paid up in stock. It proposes to purchase Missouri for $2,504,000 of REA funds and then proposes to borrow an additional $1,771,000 for making improvements and additions to the properties, making a total of $4,275,000.

Missouri Electric Power operates electric lines and systems in 20 counties south of the Missouri river. It has seven generating plants, three ice plants, one water system, 370 miles of transmission lines, 37 substations and 43 distribution systems. Larger towns it serves include Doniphan, Fredericktown, Marshfield, Mountain Grove, Sullivan and Willow Springs.

The companies contesting the proposed acquisition of the utility by the cooperative contend that the REA loan to the coop would be a violation of the original Rural Electrification Act, designed to finance rural systems in rural areas not now receiving such service. Sale of Missouri Electric to Sho-Me, they maintain, is merely part of a scheme to substitute a publicly owned and operated system for the existing utility system. They point out that the agreement between REA and Sho-Me provides for the operation of the cooperative in 59 counties, whereas Missouri Electric operates in 20. The proposed territory takes in all the state south of the Missouri River except for nine counties.

New Idaho Power Transmission Line

Idaho Power Co. is now building 53 miles of 132-kv. H-frame transmission line, using two steel overhead ground wires and Anaconda No. 000 hollow conductor. The line will extend from American Falls power plant to Pocatello substation, paralleling the existing 44,000-volt line.

The line under construction will serve a new army air base and a navy ordnance plant, the former requiring 2,000 kw. and the latter 8,500 kw. Completion of the line is scheduled for the end of this year.

At Pocatello there will be a step-down bank of transformers having a capacity of 25,000 kw. The large transformer capacity is made necessary by the difference in operation characteristics of the two lines and the large other load carried in the Pocatello district.

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Approve Sale of Company to Cooperative

The Arkansas Utilities Commission has approved the purchase of the Salem (Ark.) Light & Ice Co. by the North Arkansas Electric Cooperative, Inc., for the sum of $17,500, as of November 13, 1942. Before the approval order becomes effective, the commission said, the 160 customers of the company must become Coop members.

WAR WORKERS HONORED—Clinton R. Hanna, Westinghouse research engineer (behind President Roosevelt with hands clasped) was one of a group of ten recently honored by the President for individual achievements in helping win the war. Others, left to right, are: H. R. James, National Tube; George Smolarek, Packard Motors; Walter P. Hill, Calumet & Hecla; William G. Marshall, Chief of War Production Drive; Edwin C. Tracy, R.C.A.; Mr. Hanna; Stanley Crawford, RCA; D. W. Mallett, Borg-Warner; J. H. Kautsky, Link-Belt; J. A. Merrill, Goodyear; Donald M. Nelson, WPB chairman; Madison E. Butler, Stromberg-Carlson

Moses Charges Copper Waste

C. Hamilton Moses, president of the Arkansas Power & Light Co., speaking before a Chamber of Commerce luncheon at Little Rock recently, charged that 750,000 pounds of copper wire was going to waste in the Ozark mountains of North Arkansas because of a WPB order halting construction on the Southwest power pool's interconnecting transmission lines between the Empire District Electric system at Ozark Beach, Mo., and the Arkansas system near Norfork, to bring Nebraska and Missouri power into the pool.

WPB considered the interconnection unnecessary, he said, to bring power from the Nebraska-Missouri district to an aluminum plant at Lake Catherine. The plant is supplied by facilities of the Southwest power pool and power from Grand River, Okla., transmitted over an REA-financed line of the Ark-La Electric Cooperative.

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Nebraska Adopts Electric Rulings

The Nebraska State Railway Commission has recently adopted as the official rules of the commission for the construction, operation and maintenance of overhead and underground electric supply and communication lines the "Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines" contained in the National Bureau of Standards Handbook H32 and comprising Part 2 and the grounding rules of the Fifth Edition of the National Safety Code—"except when such rules are in conflict with the laws of Nebraska or the special rules and regulations of the commission for wires crossing over or under railroad tracks." The new rules become effectively January 1, 1943.

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Black Hills Takes Over Edgemont, S. D.

The Edgemont, S. D., power system of the Mountain States Power Co. has been taken over by the Black Hills Power & Light Co., according to a recent announcement.

Black Hills Power & Light was organized in 1941 by a group who purchased properties of the Dakota Power Co. and the General Public Utilities, Inc., in the Black Hills area. The company recently completed a generating plant at Provo, near Edgemont. It is planned to construct a line from the Proco plant to Edgemont. Post-war plans call for the connection of Edgemont with the company's lines at Custer.

BIG GAS BOOK—Holders of just plain "A" gasoline ration books may well look with envy on this 10,000-gal. book being displayed by Glen Moy, Los Angeles Bureau of Power and Light transportation division employee. The 100 coupons are each good for 100 gal. of gasoline delivered to the bulk supply tanks located on the bureau system. This represents the initial bulk allotment to the bureau for its trucks and cars under the nationwide gasoline rationing program

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Urge Purchase of Tide Water Power Co.

The purchase and operation of the Tide Water Power Co. by the city of Wilmington, N. C., or by an association of New Hanover and thirteen other southeastern North Carolina counties were recommended recently to a joint session of the city council and the county board of commissioners by Mayor Hargrove Bellamy. Public ownership of the utility, he said, would result in annual savings of $350,000 to the people of eastern North Carolina.

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Wood Substations Suggested to A.I.E.E.

Sizable and well-defined savings in steel are possible by building substations simply of wood, E. M. Adkins of Jersey Central Power & Light demonstrated at an A.I.E.E. New York section meeting on December 15. Two representatives of manufacturers joined in showing tangibly how research and design are proving basic sources of metal conservation in the electrical industry.

Upwards of two-thirds the structural steel can be eliminated by resort to wood and the retained metal can be largely standard pole-line hardware, Adkins showed by specific instances. Economy in copper is obtained by shortened runs and substitution of iron pipe for copper tubing except for heavy secondary runs and buses. His structures are framed around a minimum number of poles; cut timbers are considered only for the largest structures.

Elimination of the cartridges in the Trip-O-Link fuse afforded an opportunity to cut the metal weights and equipment cost by better than 50 percent, said L. L. Crump, vice-president and chief engineer of the James R. Kearney Corp. In showing films of interruption of 3,841 amp. at 34 kv. on the Potomac Edison system, he pointed out how by design for balanced mechanical and disruptive forces it was possible to greatly lighten the functioning and supporting parts.

Sees Plastics Expansion

Lay understanding of the, to electrical engineers, complexity of the rapidly unfolding plastics art was furthered by a simplifying presentation by H. M. Richardson, chief engineer of the General Electric plastics department. In it he showed the chemical structural origin of the electrical properties which show up as good or bad arc-track resistance, power factor, dielectric strength, thermal deformation and resistance to moisture and chemical attack. Plastics have so far only attained a tonnage of much less than one percent of steel tonnage, but he foresees a tremendous expansion after the war in all fields, including the uses involving electrical properties. Some war equipments contain upward of a hundred plastic parts. In discussion he said he expects that pending work with organic silicates will offer the best approach to impregnants most appropriate for use with fiber glass.

MEETINGS

Previously Listed

Missouri Valley Electric Association — Industrial engineering conference, Continental Hotel, Kansas City, Mo., January 13-14. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

American Society of Civil Engineers — Annual meeting, headquarters, New York, N. Y., January 20-22. George T. Seabury, secretary, 33 West 39th St., New York, N. Y.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 25-29. H. H. Henline, secretary, 33 West 39th St., New York, N. Y.

Output Estimated To Continue Rise

According to an unofficial estimate of the Edison Electric Institute, the output curve for the week ended Dec. 19 continued its seasonal upward swing and brought the new figure, for the first time, close to the 4,000,000,000 kw.-hr. mark. The estimated figure on the amount of electrical energy distributed by the light and power industry for the week amounted to 3,980,000,000 kw.-hr., as compared to 3,937,524,000 kw.-hr. for the week previous and 3,883,534,000 kw.-hr. for the week ended Dec. 5. The figure for the latest week, however, is subject to check inasmuch as heavy holiday mails have delayed the customary reports from companies and, at the time of going to press, only about 50 percent of them had been received. Considering the 3,980,000,000 kw.-hr. figure substantially accurate would mean a 13.9 percent increase over the figure for the corresponding week a year ago, as compared to a 13.3 percent increase registered a week ago.

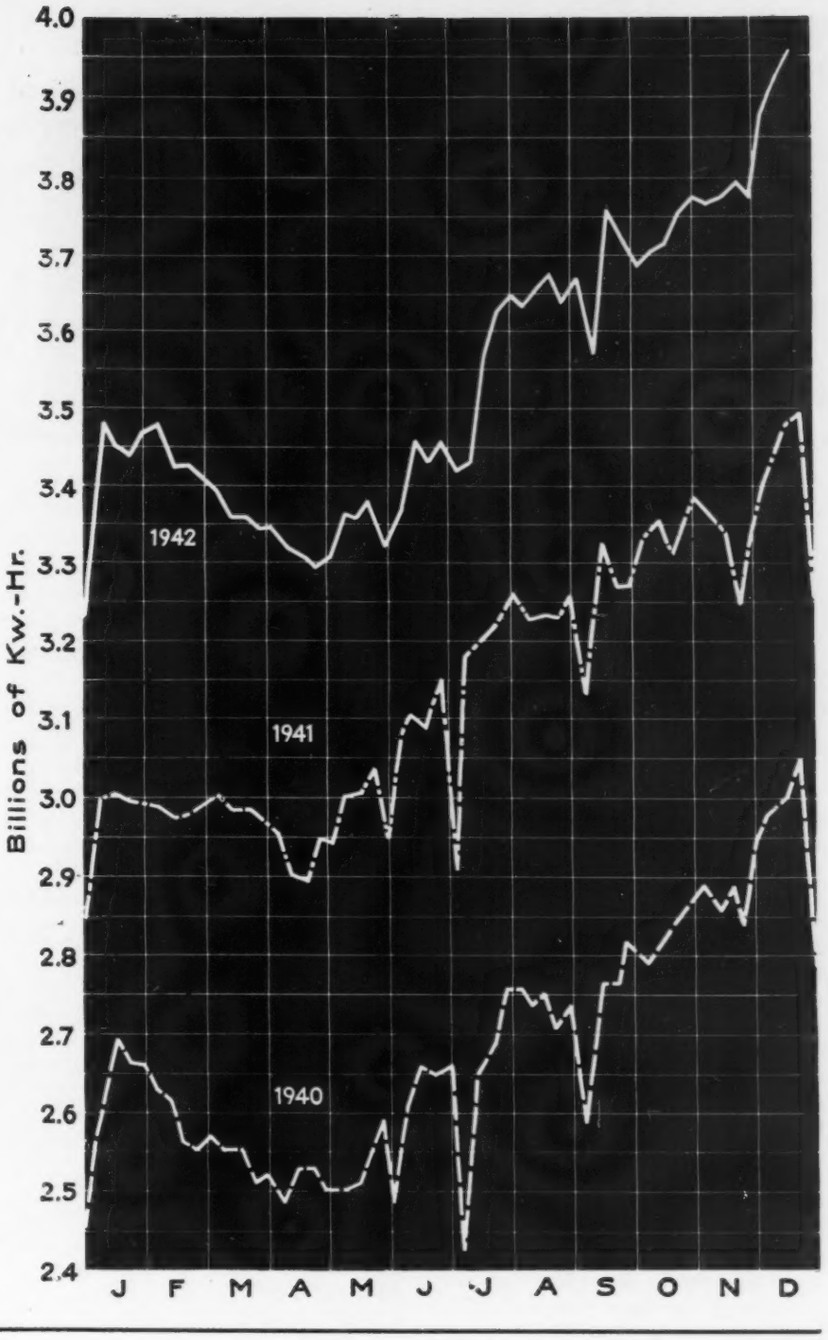
Publication of the percentage of increase or decrease shown in the table below as they appeared in the previous issue, will be resumed next week.

Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
Dec. 12	3,937	Dec. 13	3,476	Dec. 14	3,003
Dec. 5	3,883	Dec. 6	3,415	Dec. 7	2,976
Nov. 28	3,766	Nov. 29	3,339	Nov. 30	2,932
Nov. 21	3,795	Nov. 22	3,248	Nov. 23	2,839
Nov. 14	3,776	Nov. 15	3,348	Nov. 16	2,870
Nov. 7	3,762	Nov. 8	3,369	Nov. 9	2,878
Oct. 31	3,775	Nov. 1	3,380	Nov. 2	2,882
Oct. 24	3,752	Oct. 25	3,341	Oct. 26	2,867
Oct. 17	3,717	Oct. 18	3,313	Oct. 19	2,838
Oct. 10	3,702	Oct. 11	3,355	Oct. 12	2,817

Percent Change from Previous Year

	Week Ending		
	Dec. 12	Dec. 5	Nov. 28
New England	— 0.7	+ 0.4	+ 0.8
Mid-Atlantic	+ 5.3	+ 7.4	+ 5.6
Central Industrial	+ 8.4	+ 8.5	+ 7.5
West Central	+12.0	+12.1	+13.9
Southern States	+26.5	+28.7	+29.0
Rocky Mountain	+ 8.1	+ 9.7	+ 9.9
Pacific Coast	+29.3	+24.0	+20.0
Total United States	+13.3	+13.7	+12.8



Canadian Output and Exports Up

Output of central stations in Canada for October amounted to 3,166,186,000 kw.-hr., compared with 3,140,317,000 kw.-hr. in October, 1941, a gain of 25,869,000 kw.-hr. This was an increase in firm or primary power of 213,580,000 kw.-hr., but a decrease in secondary power output of 187,711,000 kw.-hr.

Exports to the United States increased from 196,578,000 kw.-hr. in October, 1941, to 207,087,000 kw.-hr. in October, 1942, all of which was in secondary power, which increased from 72,217,000 kw.-hr. to 87,374,000 kw.-hr.

Firm power produced for consumption in Canada (including line losses) amounted to 2,828,330,000 kw.-hr., a new high record, the daily average being 91,236,000 kw.-hr., as compared with 88,921,000 kw.-hr. in January, '41.

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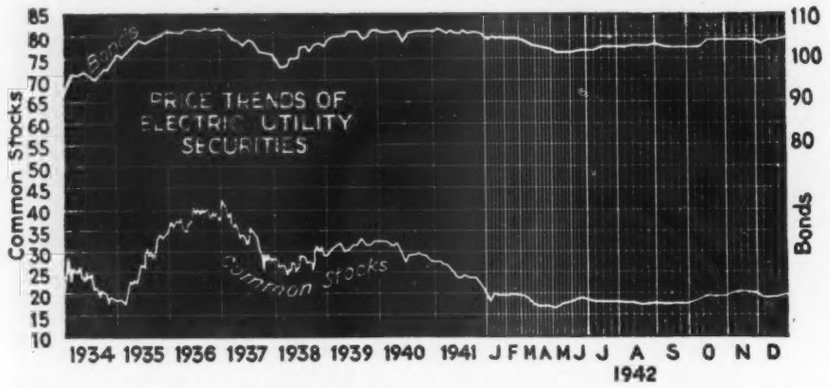
Stream Flow Above Normal

Stream flow conditions in the United States were above normal in November, except in northern Maine, Florida and northern Mississippi and in the intermountain states from southern Montana, through Arizona and western New Mexico, according to the monthly report issued recently by the Geological Survey of the U. S. Department of the Interior in collaboration with the Dominion Water and Power Bureau.

There was ample natural stream flow in major power-producing areas, the report said, and conditions in Oregon and Washington, where stream flow conditions had approached critically low rates during October, improved materially. On November 30 water storage in the United States and Canada for power, municipal and industrial use as a whole was about 180 percent of that one year ago.

Above normal conditions existed also, the report said, in central Canada extending from western Alberta across Saskatchewan, Manitoba, through southern Ontario and in Nova Scotia.

Utility Stocks Improve; Bonds Also Gain


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1934 1935 1936 1937 1938 1939 1940 1941 J F M A M J J A S O N D
1942

Prices of electric light and power securities showed improvement during the past week. "Electrical World" stock index advanced to 20.2 from 19.8 the previous week; last year, 18.7. Bonds advanced to 103.6 from 103.4; last year, 104.6

Tri-City Plans to Buy Its Common

Sale by Tri-City Utilities Co., a subsidiary of Associated Electric Co., of all the properties comprising its Ohio River electric division, to Meade County Rural Electric Cooperative Corp. and the Green River Rural Electric Cooperative Corp., for an aggregate base price of $195,000 were approved by Kentucky's State Public Service Commission and the Securities and Exchange Commission early in December.

In a new petition filed with the SEC, Tri-City proposes to use the net proceeds from the sale for the purchase of its own common stock at a price equal to its par value of $1 per share from Associated Electric Co. Net proceeds from the sale of the Ohio River electric division is estimated at $202,000. The capital stock of Tri-City will be reduced accordingly.

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Agecorp Files to Sell Ohio Units

The trustees of Associated Gas & Electric Corp. have filed a declaration with the SEC covering the proposed sale of three Ohio subsidiaries, General Utilities Co., Western Reserve Power & Light Co. and the New London Power Co., to a group of cooperatives and the village of Lodi, Ohio, for an aggregate base price of $1,100,000.

The action was taken pursuant to an SEC order of August 13 as a further step in the company's compliance with the geographical integration provisions of the Holding Company Act. With the consummation of the sale, Associated said, the three subsidiaries will be dissolved. It was further announced that the operating properties of the three subsidiaries are not capable of interconnection with those of any other Associated subsidiary.

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Arkansas Power to Call Bonds; Plan '43 Budget

The board of directors of the Arkansas Power & Light Co. has voted to call $3,200,000 of its 5 percent bonds. The bonds, part of a $35,000,000 issue dated 1926 to mature in 1966, were called at 103 for February 1. Money to call the bonds will come in part from the recent sale of the utility's water properties, according to a statement by C. Hamilton Moses, president.

Mr. Moses said the directors had approved a construction budget of several million dollars for next year. Included were funds for completion of the new $3,000,000 steam-electric generating station in the "sour-gas" fields in southwest Arkansas.

Utility Reports

	Net Income 1942	1941
*California Elec. Power and sub	$ 823,741	$ 653,939
†Detroit Edison and subs.	8,333,737	12,609,200
*Duquesne Light	10,940,689	9,954,579
*Houston Ltg. & Power	2,662,440	3,024,965
*Iowa Public Service	802,088	735,760
*Kansas Gas & Electric	1,467,854	1,503,413
*Mississippi Power	633,162	305,135
*Northern Indiana Public Service	2,558,332	2,767,655
*Pennsylvania Power	617,828	800,741
†Public Service of N. J. and subs	17,676,510	20,987,764
*So. Carolina Power	529,065	439,209
*Superior Water, Light & Power	95,627	94,749
*Washington Water Power and sub	2,358,281	1,870,291

* Twelve months ended October 31.
† Twelve months ended November 30.

FINANCIAL BRIEFS

THE SEC HAS APPROVED the petition of NY PA NJ Utilities Co. for the acquisition from Associated Utilities Corp. of $1,000,000 principal amount of Mohawk Valley Co. 6 percent consolidated refunding gold bonds, due 1981, for a cash consideration of 100 percent of the face amount, plus accrued interest. In addition, the commission approved payment by Associated Utilities of $1,000,000 to the trustees of Associated Gas & Electric Corp., as payment on account of principal on a convertible obligation, due 1963, of Associated Utilities.

AS AN AMENDMENT to a petition before the SEC, concerning a proposed merger of Lexington Water Power Co. into South Carolina Electric & Gas Co., General Gas & Electric Co., the parent, has asked the commission to permit the surrender by General to Lexington of two lots of bonds to enable Lexington to meet its sinking fund requirements, due Jan. 1, 1943. Involved are $108,300 face amount of Lexington first mortgage bonds, 5 percent, due 1968, and $125,000 face amount of Lexington convertible sinking fund gold debentures, 5½ percent, due 1953. The transaction, it is planned, will be consummated before Jan. 1.

APPLICATION OF THE Edison Sault Electric Co. for exemption from certain provisions of the Holding Company Act, for its proposed private sale of $990,000 of first mortgage bonds, series A, 3¾ percent, due 1972, has been approved by the SEC. Proceeds from the sale, which will be to three insurance companies, will be used by the company to retire bonds and notes.

UNITED GAS IMPROVEMENT CO. has subscribed to $10,000,000 of ⅞ percent U. S. Treasury certificates of indebtedness, Series E, 1943, and subsidiary companies for $1,420,000, according to W. W. Bodine, president. Total investment of U.G.I. and subsidiary companies (including subsidiary's pension fund investments) will amount to $35,371,750 principal amount of U. S. Treasury certificates of indebtedness and Victory Bonds and $727,500 of U. S. tax certificates, the announcement said.

PUBLIC SERVICE ELECTRIC & GAS CO. of New Jersey has asked permission of the SEC to buy in the open market $1,000,000 of bonds on ten subsidiary companies for $1,200,000, based on an average estimated premium of 20 percent of the principal amount of bonds proposed to be purchased.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

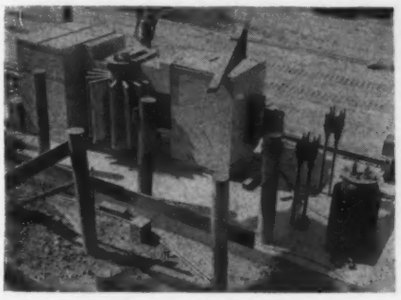
Modified Design for Industrial Substations

Indicative of the impetus that has been given substation design and application by war industries is the compact and simplified unit layout evolved for a new Pacific Coast shipyard. These standardized units are located in sets of two or singly dependent upon the size of the load to be served, adjacent to a shipway, shop or other fabricating plant. The unit substation may be for power only, or for light and power. A separate design has been worked out for lighting alone.

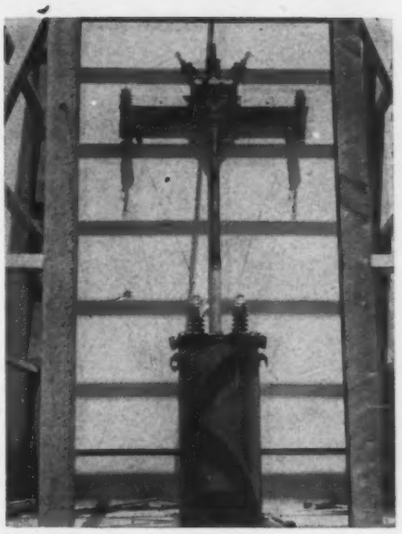
A standardized size of 1,200 kva. was adopted, rated 12 kv./480 volts, three phase. The units are metal-clad and are equipped with drop-out primary oil circuit breaker and pull-out air-break secondary breakers. For maximum service continuity each unit is served by two primary feeders. With the truck-mounted drop-out oil switch it is possible to connect the substation to either of the two primary feeders.

Cables are pulled directly into each section of the unit through risers to potheads and through removable links designed to permit speedy removal of a section of the cable in case trouble demands that any portion of the system be isolated.

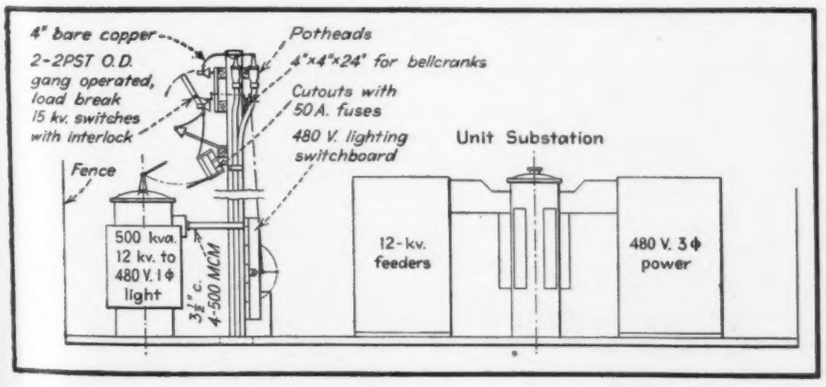
To insure maximum continuity of operation and to take full advantage of load diversity, the secondaries of adjacent substations are tied together through 400-amp., 480-volt, three-phase circuit breakers and 500,000 cir.mil cable. Individual secondary circuits are loaded to capacity on the basis of 400 amp. per circuit.



UNIT STATION being installed; service at 12 kv. is brought in on risers to lighting transformer at right and power section at left



SIMPLIFIED LAYOUT of 12-kv. individual single-phase lighting substation is indicated in this view which shows how primary comes through riser to the pothead in the center


4" bare copper
2-2PST O.D. gang operated, load break 15 kv. switches with interlock
Potheads
4"x4"x24" for bellcranks
Cutouts with 50A. fuses
480 V. lighting switchboard
Unit Substation
Fence
500 kva. 12 kv. to 480 V. 1φ light
3 1/2" c. 4-500 MCM
12-kv. feeders
480 V. 3φ power

ELEVATION of typical outdoor unit substation designed for both power and lighting service for a Pacific Coast shipyard

Lighting substations are single phase and are served from one of two sets of feeders that circle the yards. Load interrupter disconnect switches connect the lighting substations to either of the two 12-kv. primaries. These interrupters serve as primary circuit breakers, with a saving of about 80 percent in cost. Phase loads are balanced across three sections of the yard.

The lighting substations are rated 12 kv./480 volts for shipways and 240–120 volts on the secondaries for buildings and shops. Lighting substations are connected on the secondary side in the same manner as the power units. Feeders carry 200 amp. at 480 volts and run to shipway staging, where they terminate in 480/240-120-volt, three-wire, single-phase dry type transformer. Leads from these

BOSTON EDISON treated about 25,000 bulbs in approximately three weeks at a cost of about 2 cents each

are run into an adjacent panel distribution center. Incidentally all liquid-filled transformers on the job contain non-flammable fluid.

•

Blackout Spraying at Low Cost

Under pressure of war necessity, Boston Edison Company faced the problem of spraying about 25,000 incandescent street-lighting bulbs with a dimout stripe to prevent sky glow and minimize flux distribution beyond the adjacent ground area. These lamps were classified in 800,- 1,000- and 2,500-lumen ratings. To achieve the spraying with a blackout type paint quickly and at low cost, the company's equipment service division in the transmission and distribution department utilized a ¼-hp. motor-driven turntable device already available in its service buildings for spraying metal fixture canopies.

The bulbs were sprayed by hand while continuously revolving in cylindrical containers mounted on vertical shafts, the jigs being equipped to light automatically each bulb when the lamp was placed in the container. It was necessary to apply as thin a coating as is consistent with opacity, and the lighting of the bulbs greatly aided this objective. The stripe widths varied from 1⅜ to 2½ in. according to the bulb size. In an eight-hour day about 1,500 bulbs were treated, an average of 20 seconds per bulb. In general, drying was in the open air in racking boxes set up near the spraying equipment, with some aid from a fan on occasion. The approximate cost per bulb, including paint and labor, was about 2 cents.

Recent experiments have shown that longer life of the dimout band under weather and heating conditions can be obtained with sodium silicate spraying, using a white under coat and black over coat on the outside surface of the bulb. The white coating redirects perhaps 20 percent more light (which would otherwise be lost) upon the street surface without adding to the sky glow. The white coating also reflects much of the radiant heat away from the banding and out through the transparent glass above and below, while such radiant heat as gets through this coating is rapidly dissipated through the outer black coating. It is now planned by Boston Edison to use sodium silicate generally in this work.

•

Tabulate Wear Data to Guide Replacement

Shown is the type of tabular record of part renewal and wear kept at the Michigan City plant of Northern Indiana Public Service Company to guide maintenance and parts renewal on coal pulverizing mills and exhauster fans.

For each overhaul date the tabulation carries a record for the mills of: (1) Total hours in service to date; (2) hours in service since last overhaul; (3) tons of coal pulverized to date, and (4) since last overhaul; (5) data on the dimensions of rings, balls and wearing plates, and (6) record of parts replaced by date.

From the tabulation it is possible for plant engineers not only to determine the service hours and tonnage life of parts installed but also the rate of wear in inches-per-service-hour or per-ton for parts already in the mills. It is thus possible to schedule replacement accurately and also arrive at

Date	Hours in Service: Total to Date	Hours in Service: Since last Overhaul	Tons Pulverized: Total to Date	Tons Pulverized: Since last Overhaul	Rings: Top	Rings: Bottom	Rings: Interm.	Balls: Top	Balls: Bottom	Wearing Plates: Tube	Wearing Plates: Spider	Wearing Plates: Spider Guide	Remarks	Exhauster: Hrs. & Tons	Exhauster: REMARKS
12-30-37								8 5/16"	8 1/8"				Added 1-7 15/16" Ball to Bottom, Springs set at 15 1/2"	25018 207098	3-25-38 Inst New Blades of 1/2" Mild Steel 45 1/2" Dia, Welded Horn Parts on Hub
7-1-38	24976	3713	222596	31314			■ Lower Shoe	8 3/16" ■	10"				Solid Int. Ring Remachined as Per SI-8-210 to take lower wearing shoe. Outer lip of Top Surface cut off 1" x 1" Steel Band shrunk on bottom, Ring remachined as per SI A 362. Put 13 new 10"balls in bottom race, 010 balls put back in top. Springs 15¾" Added 1 7-13/16 ball to top and 1-9 3/8 to bottom. Installed hood on trap doors springs set at 18"	26974 222596 28773 237432	3-3-38 Inst. new blades of 8" steel 456"D. Put in 3 new 1" M.S. Liners & B.C.M. 8-6-38 Inst. new blades of 8" M. Steel 456" Dia
12-16-38								7 7/16"	8 15/16"				Added 1 - 9" Ball to Bottom Race		
1-30-39	30355	3281	269740	27145		◤		◤ 13-2 31/32	16 68				Inst. Old Bottom Ring Removed from W. Mill 5-8-37. Also 6 Liners 17-7 31/32" Old Balls in top, Bottom Balls (16-68) put back in service.	30295 269740	1-30-39 Inst new blades of 8" M Steel 456" Dia
1-7-39								7 11/32					Added one ball to top race		
5-24-39	31988	1055	269810	33276	■	■	■	■ 36"	■ 10"				Inst. new top ring, new top & bottom shoes and new bottom ring 16-36" top and 13-10" bottom, hardened steel alloy balls	31908 269810	5-16-39 Inst. new blades of 1/16" M. Steel 456" Dia
5-8-40								15- 8 7/8	16-9 3/8"				Added one ball to top & bottom race	33960 280399	4-12-40 Inst. new blades of 7/16" M. Steel 456" D
11-2-40	35997	4089	297846	34820	■	■	■	■	■				Inst. remachined top ring. New top & bottom shoes on repaired centerpart and new bottom ring 16-36" Top and 13-10" Bottom Balls	35997 297846	11-2-40 Inst. new blades of 7/16" M. Steel 456" D
2-27-41	38936	2648	318202	20936		◤		15- 8 5/8	16-8 5/8				Inst. new springs set at 16. Removed 15-8 5/8 top and 16-8 7/16 bottom balls put in old 8 3/8" hardened steel balls 15 in top, 16 in bottom	38936 318202	5-27-41 Inst. new blades 7/16" M. Steel 456" Dia
10-1-41													Inst. new throat ring. Inst. band on yoke (1 3/8" half oval) giving 1 5/8" opening. Build up rods & Reversed Top & Bottom Balls. Added 1 to top 1 2 to bottom (soft)	39461 327290	10-1-41 Inst new blades 8" M. Steel, 2 coated with abrasion resistant steel
12-15-41	40570	2134	327122	18020				16-7 13/16	17-0				Removed concrete from Windbox & Port Holes. Put in new Concrete see print		■ Denotes Renewal ◤ Denotes Used Parts

CHART on coal mills and exhauster fans is index to life of replacement parts and wear-resisting materials

Add Them to Your Check List of Safety Measures

✓ Fire-alarm Systems
✓ Fire Walls
✓ Sprinkler Systems
✓ Pyranol Transformers

. . . Because Pyranol Cannot Burn

FROM THAT ONE FACT SPRING MANY BENEFITS:

✓ YOU CAN INSTALL THEM INDOORS *SAFELY:* No Pyranol transformer has ever burned or contributed to a fire. Even if heat from a surrounding blaze ruptures the tank, the fire hazard will not be increased.

✓ VAULTLESS INSTALLATIONS ARE POSSIBLE: You can install them indoors or outdoors —in the basement, on the factory floor, on overhead beams, or on the roof. Such flexibility assures you major savings in time, floor space, and construction materials.

✓ PRIMARY POWER CAN BE RIGHT AT THE LOAD: Voltage regulation is improved, line losses are lowered, copper is saved—often up to 30,000 lb in large industrial installations.

AND BECAUSE THEY ARE *LIQUID-FILLED* THEY HAVE:

✓ — —A HIGH, *LASTING* DIELECTRIC STRENGTH—an important safeguard against damage from voltage surges caused by lightning and switching

✓ — —PRESSURE-TIGHT TANKS, which protect vital parts from dust, dirt, and sabotage

✓ — —A HEAT-STORAGE CAPACITY that is ideal for emergency overloads

PYRANOL* transformers fit naturally into your wartime campaigns for (1) safety, (2) stepped-up production, and (3) conservation of critical materials.

The absence of fire hazard will help you with campaign No. 1. A reliable power supply, easily installed *where you want it*, is an important consideration for No. 2. Fireproof vaults being unnecessary, vital construction materials are saved. Since Pyranol transformers can be located at the load center, the runs of secondary copper are greatly reduced. These are important factors in helping you with point No. 3.

Since the introduction of Pyranol, in 1932, more than 4,000,000 kva of new transformers have been built using this type of cooling and insulating liquid. Hundreds of users are finding that Pyranol transformers assure the lowest total installed cost commensurate with the highest degree of safety.

Ask your G-E representative for the complete story, or write for Bulletin GEA-2048D. *General Electric Company, Schenectady, N. Y.*

**Pyranol is the G-E trade name for askarel.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

GENERAL ELECTRIC

an index of the wear resistance qualities of different metals used in replacement parts. The obvious result is better wear control, longer part life and an increase in the time between overhaul periods.

The same tabulation, for exhauster fans, carries a record of the number of hours and tons of coal handled to date. Difference in service hours and tons of coal handled between blade replacements is a guide to scheduling of future blade replacements.

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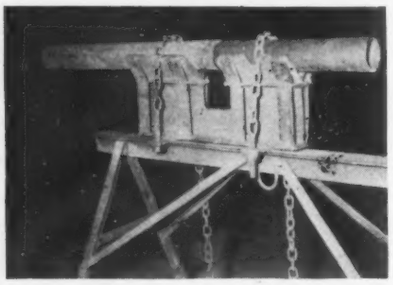
Tube-Welding Jig



For positioning the ends of boiler tubes to be welded in place maintenance men at the Fourth Street generating station of the Nebraska Power Company use the jig shown. It consists of two short lengths of 3 x 3-in. angle welded to the top of a section of I-beam and braced with short scrap lengths of steel strap. The tubes to be joined are clamped in the V of the angles by a chain. Steel sawhorse shown is not a part of the jig.

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Compact Holder for Repair Parts

When steel again becomes freely available in ordinary domestic commerce, an extremely handy device observed in the appliance service department of the Durham (North Carolina) Public Service Company will probably find wide use among other utilities. The device is a circular arrangement, part drawers, part shelves, part bins, rotatable on a supporting pedestal and in the various compartments of which are kept the stock of small refrigerator parts. For the not large meter department the cabinet would be ideal for the entire stock of meter and register repair parts.

Basically, the cabinet is a series of circular shelves, about 36 in. in diameter and supported on a center column about 6 ft. high. The shelves are adjustable in height and in separation between themselves on the column. Built up of sheet metal parts on the shelves, and of such sizes and degrees of compartmental subdivision as are desired, are sector-shaped, open-top bins and drawers in which the many different meter and register parts are stored. Cards set in holders on the curved fronts of the bins and drawers tell what parts are contained in them. The cabinet at Durham has ten levels which carry several hundred compartments, ranging from bins big enough to hold meter magnets and such large pieces to small partitioned spaces in drawers in which register gears, cams and similar tiny parts could be kept.

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Conductor Material for Buses*

By WILLIAM DEANS
Chief Engineer
I-T-E Circuit Breaker Company, Philadelphia

An electrical bus is an electrical device and as such must be designed like any other device. Usually temperature rise governs the choice of designs. In some cases, as in electrical furnaces, voltage drop may be the important consideration. Economic considerations involve a balance between the value of the power saved and the investment necessary to prevent greater power loss. A design item of paramount importance for a bus is conductor materials.

Copper is used most extensively, presumably because of the balance obtainable by its physical and electrical characteristics, availability and economic factors.

Aluminum conductivity is approximately 60 percent that of copper. Even though the aluminum conductors are larger in cross-section than the copper for the same current, the aluminum conductor has the advantage of its very much lower weight. Also, because the aluminum conductor is larger in dimensions, it has inherently a higher section modulus and so may be better able to stand the stresses because of the forces between the conductors. The spacing between supports of the bus might be greater in the case of aluminum. Skin effect is lower for aluminum than for copper (although the difference is not great).

In addition to use of aluminum as primary conductors, the metal has another use in a bus structure and that is for inclosing a bus.

Silver has high conductivity, which is an advantage for its use as electrical bus and conductors. Cost of silver seldom can be justified economically.

Steel pipe as an electrical conductor has had a limited use. With a ⅛-in. slot in the pipe capacity is increased, varying from 26 percent for 4-in. pipe to 52 percent for 2-in. pipe. The increase is due to reduction in hysteresis and skin effect losses. For additional data refer to the following articles in ELECTRICAL WORLD:

"Evaluate Steel Pipe as A.C. Conductor," by Stanley C. Killian; on page 67 of April 18, 1942, issue.

"Deflection Chart for Steel Pipe Buses," by Walter S. Scheering; on page 82 of October 17, 1942, issue.

An accompanying table gives some comparative data relative to characteristics of copper, aluminum and silver.

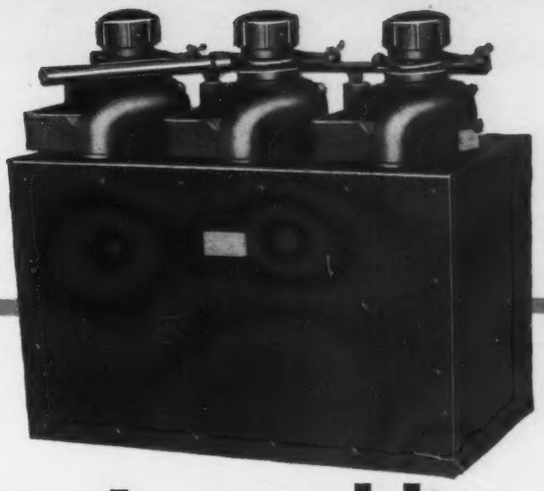
*This is the first in a series of seven articles on the general subject of bus design.

Physical Properties of Bus Material

	Copper [a]	Aluminum [a]	Silver [b]
Specific gravity	8.93	2.70	10.50
Weight, lb. per cu. in.	0.322	0.0977	0.381
lb. per cu. ft.	558.	169.	657.
lb. per ft. per sq. in. cross-section	3.875	1.172	4.56
Resistivity (at 20 deg. C.)			
Microhms per inch cube	0.686	1.11	0.680
Microhms per ft. per sq. in. cross-section	8.23	13.36	8.15
Ohms per cir. mil, ft.	10.48	17.0	10.35
Specific heat, cal. per g. per deg. C.	0.092	0.220	0.057
Temperature coefficient of linear expansion, per deg. C.	0.0000168	0.000023	0.0000188
per deg. F.	0.0000093	0.000014	0.0000105
Temperature coefficient of resistance, per deg. C.	0.00393	0.00403	0.00380
per deg. F.	0.00218	0.00224	0.00210
Ratio: Density referred to copper	.....	0.304	1.177

[a] Hard drawn. [b] The data for silver are for the "silver" which may be commercially available for bus conductors. The resistivity, especially, depends upon the purity of the metal and its hardness.

New!



METAL-ENCLOSED
Oil Fuse Cutout Assemblies

1 ***For Economical Short-circuit Protection and Switching***

2 ***Easy to Install***

3 ***Single- or 3-phase Designs***

Complete metal-enclosed, three-phase, oil fuse cutout assembly mounted on apparatus. Assembly for separate mounting is shown in illustration above.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

These new cutout assemblies, for wall or direct-to-apparatus mounting, permit totally metal-enclosed installations, either single- or 3-phase. They save installation labor because each unit is factory-assembled with flexible, insulated cable leads ready for connection to either single- or multi-conductor cable. The leads enter the individual cutouts above the oil level, thus preventing loss of oil. Switching is done by merely throwing the handle through a 90-degree arc. Fuse carriers can be removed separately without disturbing the gang-operating mechanism.

Cutouts Proved by Service

G-E oil fuse cutouts, Type D&W, distinguished through more than 20 years for reliability and safety in service, are recognized for high-current-interrupting ability, facility for switching, high-speed operation, and quiet performance—in both central station and industrial installations.

Approved for Indoor Application

These metal-enclosed assemblies are particularly well adapted for use (indoor or outdoor) in industrial plants for branch circuits, individual transformers or banks, motors, control apparatus, and electric-heating and other equipment. The use of oil fuse cutouts for indoor application has long had the approval of the National Electrical Code.

Available Models and Ratings

The new assemblies can be supplied for wall or direct-to-apparatus mounting, with openings for conduit, cable, or pothead connections and for single- or three-phase applications.

For Short-circuit Protection and Switching		For Switching Only (with copper blade instead of fuse link)	
Volts	Amperes	Volts	Amperes
2500	100, 200, 300	2500	150, 250, 350
5000	50, 100	5000	150, 250
7500	100	7500	150

Ask your G-E representative for complete information. Or, write for new publication, GEA-3904. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

HOW TO DETERMINE

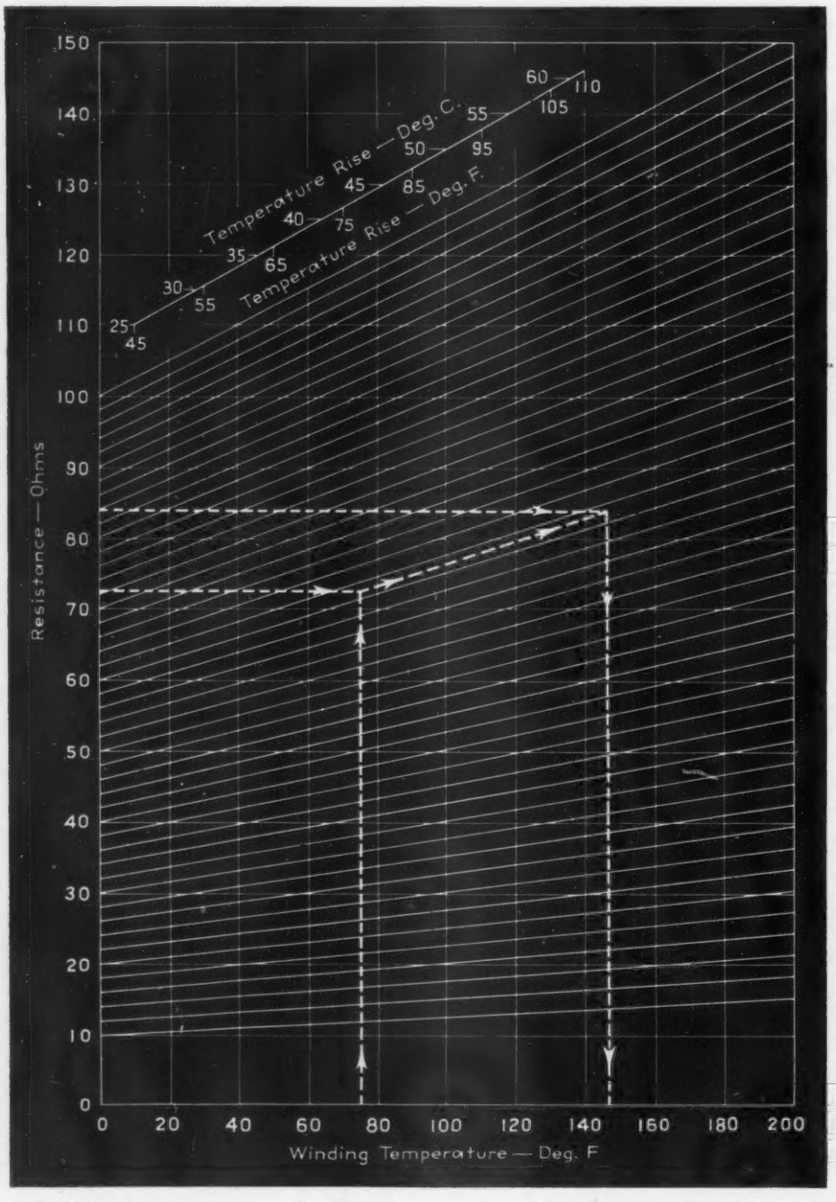
COPPER WINDING TEMPERATURE BY RESISTANCE METHOD

By IVOR S. CAMPBELL

Assistant Director of Development and Research, Sunbeam Electric Manufacturing Company, Evansville, Ind.

Chart gives hot operating temperature of a copper winding when a cold temperature reading and the hot and cold resistance readings are known. It is based upon the equation

$$\frac{R\ (\text{hot})}{R\ (\text{cold})} = \frac{t\ (\text{hot}) + 390}{t\ (\text{cold}) + 390}$$



INSTRUCTIONS for Use of Chart

Use graph at top of chart for conversion of Centigrade and Fahrenheit temperature readings.

Locate intersection of cold winding temperature (on a vertical extension) and cold winding resistance (on a horizontal extension).

Follow along diagonals to intersection of hot winding resistance (on a horizontal extension).

Read downward vertically for hot winding temperatures.

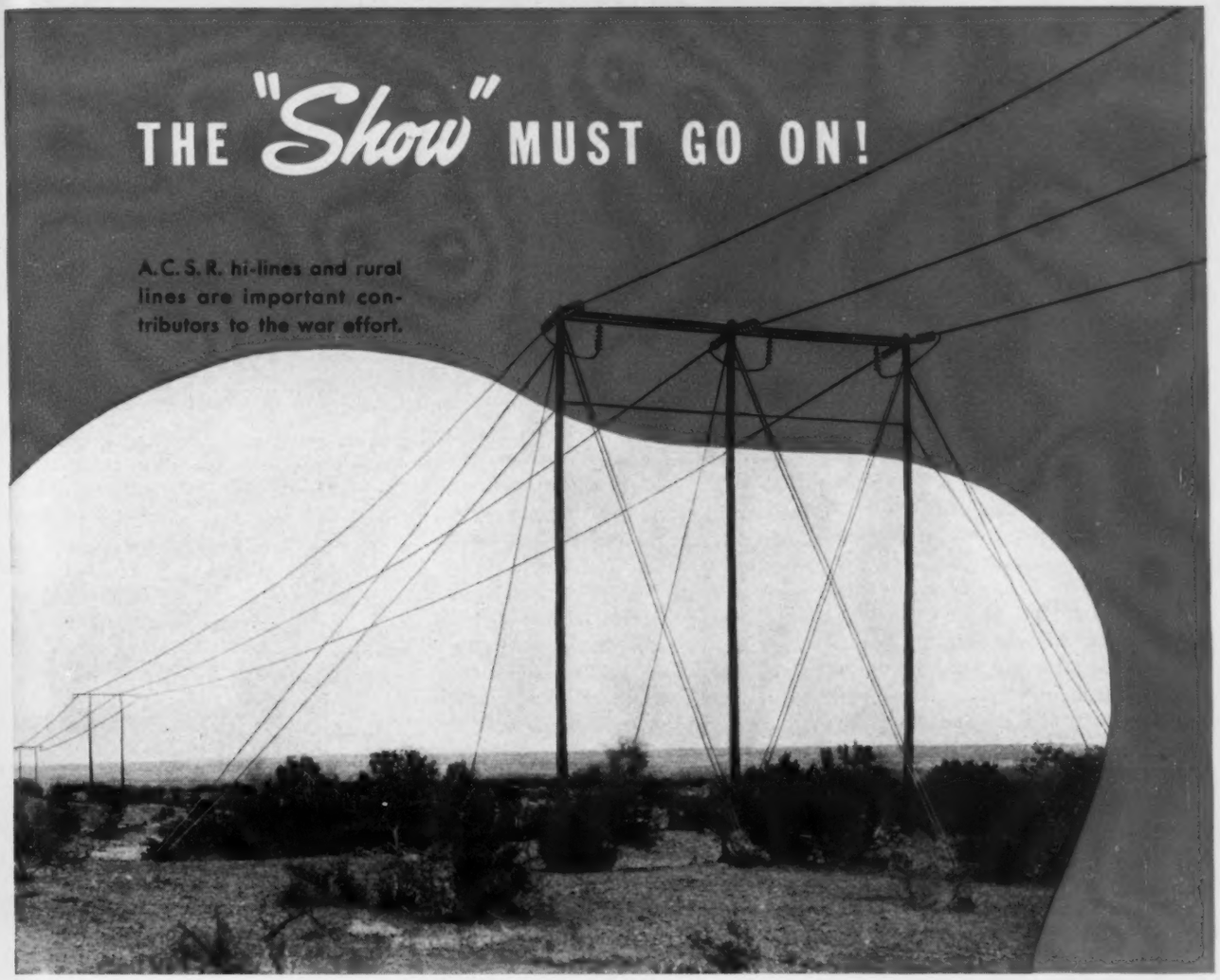
EXAMPLE

Assuming that a transformer winding had a resistance of 0.727 ohm at 75 deg. F. and operating under full load the winding had a resistance of 0.84 ohm, then on the chart the operating temperature is found to be 147 deg. F.

The solution—locate the intersection of 72.7 horizontally and 75 vertically; follow the diagonal between the inclined lines until it intersects 84 horizontally; then read downward vertically to obtain the winding temperature of 147 deg. F.

With an original temperature of 75 deg. F. and a final temperature of 147 deg. F. the temperature rise is 72 deg. F. Referring to the temperature conversion scale at the top of the chart, 72 deg. F. is the same as 40 deg. C. and the temperature rise may be compared with the permissible nameplate value.

THE "Show" MUST GO ON!



What better rallying-cry could you find for the men who are maintaining your power lines? Hi-lines carrying power to vital war industries, and farm lines feeding the rural production front, all must be kept on their mettle.

Take the Government's word for it, the country's power lines have got to be equal to the tremendous responsibility being placed on them. This requires proper maintenance, and that means the right materials correctly installed. Ruling P-46 permits you to obtain these materials.

There are places, of course, where substitute materials and methods can keep power lines going "for the duration", without drawing on the limited supply of essentials. Alcoa engineers may be able to suggest such substitutes and can assist in developing your ideas.

Alcoa engineers are always available to advise you on methods of getting the most work out of your A. C. S. R. lines. Write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

A.C.S.R.

A·C·S·R *Aluminum Cable Steel Reinforced*

ON RURAL POWER LINES AND HI-LINES

Maintenance of Insulating Oil

V. Oxidation Inhibitors*

By L. M. LIMPUS
Superintendent of Reclamation,
Oklahoma Gas & Electric Company

Once the natural oxidation "inhibitors" have, to a certain extent, been rendered chemically inert by the normal deteriorating processes which exist under most insulating oil operating conditions sludge formation is manifest. This may occur at various neutralization numbers, depending in no small degree upon the source of the crude and the extent of filtration and acid treatment in the refinery. Under-refined oils generally develop considerable sludge at low acidities, while over-refined oils generally develop little sludge at much higher acidities. Most English oils are of the over-refined type and must be operated within definitely prescribed limits. American oils are "normally refined" to give good stability in American apparatus with respect to the formation of acids and sludge.

Two Stages of Oxidation

There are perhaps two stages of oxidation, a primary stage during which oil-soluble products are formed, and a secondary stage during which the primary oil-soluble products are polymerized and then precipitated as oil-insoluble sludges. These insolubles, once precipitated, are satisfactorily removed by mechanical separation in the centrifuge and blotter press, but the oil insolubles (which include peroxides, aldehydes, ketones, resins, organic acids, dissolved moisture and absorbed oxygen) remain in the oil, which is now saturated with them, ready to continue the precipitation of sludges with little, if any, interruption. Although a severely sludged transformer, regulator or bushing may be thoroughly cleaned and all trace of sludge removed from both the unit and the oil, the oil is not satisfactory for reuse until the oil-soluble compounds are also removed, unless the operator is content to repeat this thorough cleaning operation quite often, and at an ever-increasing tempo until it may become necessary to install a permanent bypass filter. And even then something must eventually be done about the increased acid concentration which will eventually destroy the insulations.

Tentative limits of acidity have been arbitrarily set by some operators at a neutralization number of 0.5 to 0.75 for large station-type power transformers and at 1.0 to 1.5 for the smaller distribution transformers and regulators. Unless the electric system is compact and so equipped that the cost of oil replacement and transportation can be held at a low figure, it may prove uneconomical to hold rigorously to these values. It appears that, even the absence of appreciable sludge, acidities, in the order of 3.0 MG KOH should not be tolerated, and appreciable sludge at even low acidities would indicate the necessity of oil replacement. Individual acid determinations are of doubtful value when considered alone, but when they are considered in connection with oil color, resin content and power factor, and referred to previous measurements for the oil in question, they may be considered of much practical value as positive indicators of oil deterioration. Based upon the experience of our company an average annual increase in neutralization numbers of 0.1 MG KOH for open-type transformers and regulators, 0.05 MG KOH for conservator-type and instrument transformers, 0.03 MG KOH for oil circuit breakers and 0.01 MG KOH for inertaire equipment may be expected.

*This series began in the October 17 issue of "Electrical World."

•

Rear Axle Housing for Valve Standard

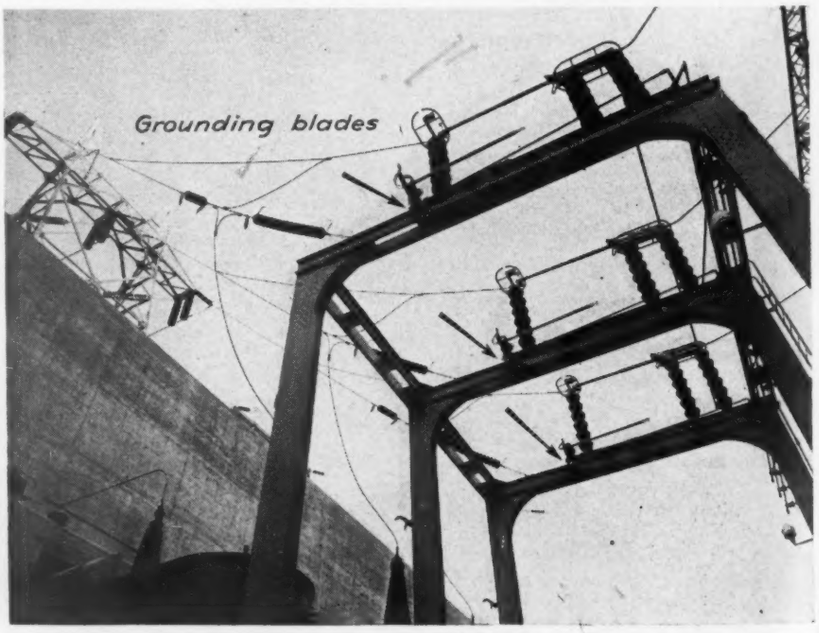
By W. E. VAN DEUSEN
Chief Engineer, Electric Department,
Rockville Center, N. Y.

When a 2,500-kw. Nordberg diesel engine-generator was added recently to the municipal plant difficulty was experienced in getting a standard to inclose the stem for the cooling-water valve placed beside the engine. A completely satisfactory result was obtained by using one of the halves of a Ford rear axle housing obtained at one of the town's auto graveyards. It is just about the right height and taper for appearance as well as serviceability.

•

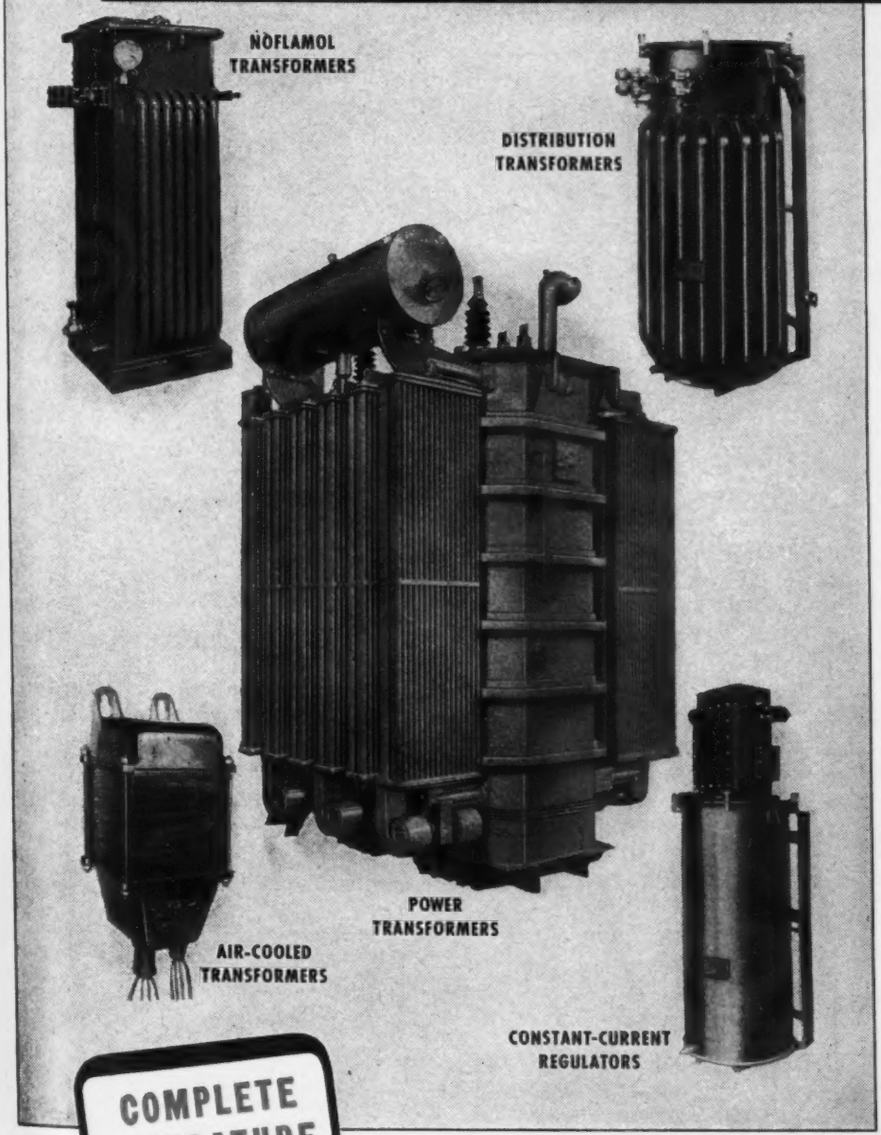
230-Kv. Switch Has Deicing Feature

Because wind-blown spray from Grand Coulee Dam might result in heavy icing of the 200-ft. takeoff leads between the transformer switchrack and the structures on top of the power house USBR engineers worked out a method of passing a low-voltage heating current through these leads;



BY INSULATING the grounding switch low-voltage current for deicing can be passed through the 230-kv. leads between the clip insulator and the takeoff structure on top of the power house

WAGNER TRANSFORMERS STAY ON THE JOB IN WAR TIME...as in peace time!



Wherever the use of dependable electric power and light is of vital importance, Wagner Transformers are doing their part in speeding up our war program—in industries producing victory material, electric light and power plants, government construction projects, airports, army cantonments, warships and merchantmen.

Wagner transformers, during many years of service to industry, have proved their ability to furnish unfailing power, and it is only natural that they should be selected for the key points of power distribution in this time of war.

Wagner builds all types and sizes of power and distribution transformers stud-bushing type; primary-pocket-stud type; sub-station and subway types; single- or three-phase; rural-line; air-cooled; Noflamol; and Type Y-H Constant-Current Regulator.

Because of large plant capacity, modern manufacturing facilities, and years of engineering and manufacturing experience, Wagner can give immediate attention to all your transformer requirements.

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Bulletins TU-180 (distribution) and TU-181 (power), illustrate and describe the complete line of Wagner Transformers. They will be sent FREE. Write for copies today.

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polishing wax was not found satisfactory, and in fact actually cut down the wet flashover voltage. Paste, on the other hand, somewhat increased the wet flashover voltage.

Wax was applied with a cloth kept well loaded with wax at all times. "Be sure to get a good coat on," cautions D. R. Nankervis, transmission engineer. "One coat is sufficient, but see that it has covered all surfaces. After it has set up just a little, polish the surfaces, but do not let it set up hard or the effect will not be as satisfactory."

•

Two-Rate Meter for Off-Peak Loads

By PAUL MacGAHAN

Westinghouse Electric & Manufacturing Company, Newark, N. J.

For the purpose of facilitating the encouragement of off-peak loads, a modified form of the conventional recording demand meter has been

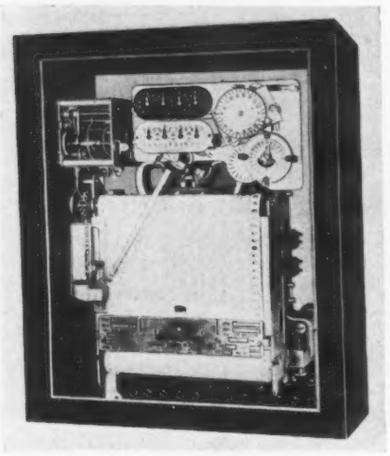


FIG. 1—Two-rate demand meter

placed in service by a large utility company.

As shown in Fig. 1, the meter comprises not only the usual watt-hour register and demand chart but also an additional off-peak or night-time register. The white register records the kilowatt-hours consumed during the day and the black register records the kilowatt-hours consumed during the night.

The watt-hour meter actuates the recording demand pen and chart continuously in the usual manner, on the block interval principle.

The integrating registers, however, are alternately thrown into mesh with the watt-hour meter movement by

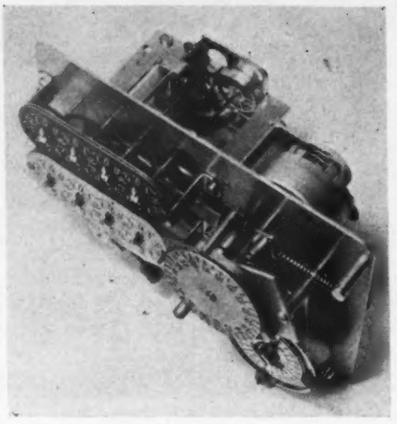


FIG. 2—Detailed view of two-rate register

means of a two-rate time-switch mechanism, which is activated by a miniature synchronous timing motor as shown in detail in Fig. 2. However, instead of operating contacts as usual in the case of time switches, a simple gear-shifting lever engages the gears which drive the registers, changing from one register to the other at the exact times for which the timing dials are set.

The additional dial, shown above the timing dial in the illustrations, indicates how many on and off operations have taken place since the last meter reading. By means of this meter two-rate metering, including two-rate demand, may be applied as the demand chart indicates the demand during both the high- and low-rate periods, and the time of the demand is registered in the usual way on the chart.

Previous to the introduction of this meter two-rate demand metering required the installation of two separate meters. The usual practice was to install an ordinary watt-hour meter controlled by a time switch, for off-peak registration, and a recording demand meter to measure both off- and on-peak kw.-hr. demand. These functions are now automatically performed by the two-rate recording demand meter illustrated.

•

Selective Pumping Avoids Acid Waters

By C. A. MILLER

Operating Department, Central Illinois Public Service Co., Springfield

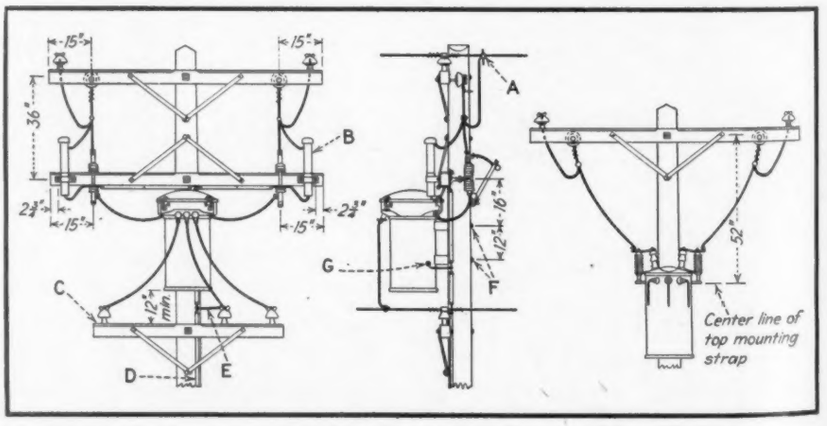
The terrain supplying water to one of the power plants is polluted with acid mine-waters, so that at times the river is unusable at the station. By simple chemical tests the river water is checked for pH content and acid content, and until the water is suitable for use it is allowed to flow past the plant without any of it being taken into the system. During peak runoffs after showers, however, when the water becomes serviceable, the pumps are put in operation and enough good water is stored in the company's reservoir to permit operation of the plant during seasons when no water is available.

•

Pole Mounting of 3- to 25-Kva. Transformers

Mounting arrangements for 6,900-230/115-volt, single-phase, 60-cycle transformers in capacities of 3 to 25 kva. inclusive are shown below. This is a standard practice for the West Penn System.

Primary clamps are used at *A* for tapping the 6,900-volt circuit. At *B*



STANDARDIZED PRACTICE for transformer installation, up to 25 kva. inclusive, to supply 230/115 volts, single phase from a 6,900-volt distribution circuit; self-protected transformer installation shown at right

Electric Welding and TIREX CABLES

Welding, as a process, is very old but with the advent of electric welding new fields of usefulness were opened up. Along with the rapid development and steady improvement of electric welders there have been equally interesting and important changes in the power and electrode cables used with them. Cables for such service must have flexibility, they must resist abrasion and they must be economical in operation.

Among the first TIREX rubber-sheathed cables designed for special work were TIREX Welding Cables having conductors made up of thousands of small copper wires to obtain flexibility (#4/0 has 5341), a tough rubber sheath for resistance to abrasion and with every promise of unusual serviceability. Performance records have repeatedly shown TIREX Welding Cables to be unexcelled in every way for the work they were designed to do.

TIREX SELENIUM Rubber Armor — Unequalled for Long Life Toughness and Resistance to Abrasion

TIREX rubber-sheathed Welding Cables are subject to War Production Board restrictions governing the use of copper and rubber but even with necessary modifications they still are suitable for the rough-and-tumble work of welding and can be depended upon for excellent performance. While they are not available for purely commercial uses they should be specified and used by industries on essential war work having high priority.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

is indicated a 6,900-volt arrester. Secondary risers from transformer are run to *C*, a four-pin, 5-ft. 7-in. crossarm. *D* is ground molding. Loops are to be made in ground wire to clear crossarm brackets and guy wire. *E* is connection of arrester ground to secondary neutral. A 300-volt arrester is used between ground and secondary neutral where no waterpipe grounds are available. At *F* 5/8-in. through-bolts are used to fasten the transformer to the pole. The bolt spacing will be 24 in. for a 25-kva. transformer. *G* is a ground for the transformer case.

When self-protected transformers are used fuse switches and arresters are omitted; also, transformer case and secondary neutral are to be connected to common ground.

•

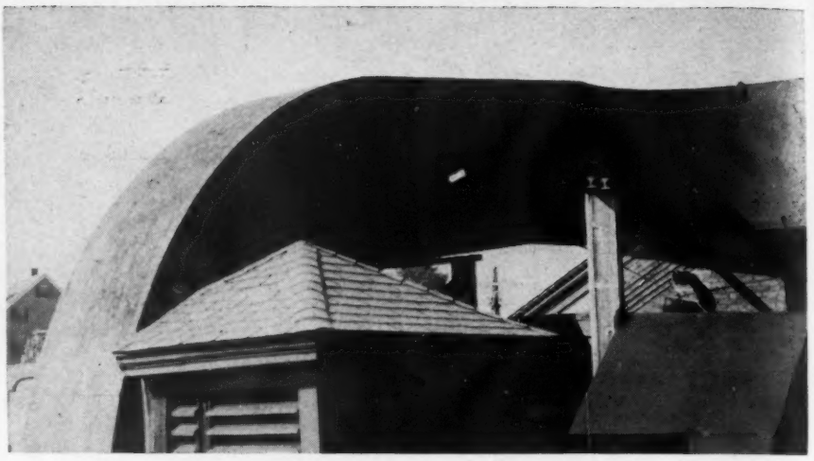
Temporary Flue Erected in 20 Hours

When one boiler in a battery of four was removed to provide an isolated compartment for a new 754-kw. Diesel-G.E. generating set at the plant of the Marblehead (Mass.) Electric Light Department it was necessary to take down part of the existing flue system and provide new connections between the remaining three boilers of the battery and the station chimney. This had to be done quickly to enable the boilers to supply steam to the plant turbine units on the next day's evening peak. About 19½ hours was required to complete the installation, which will remain in use until later developments at the plant call for modifications of the layout.

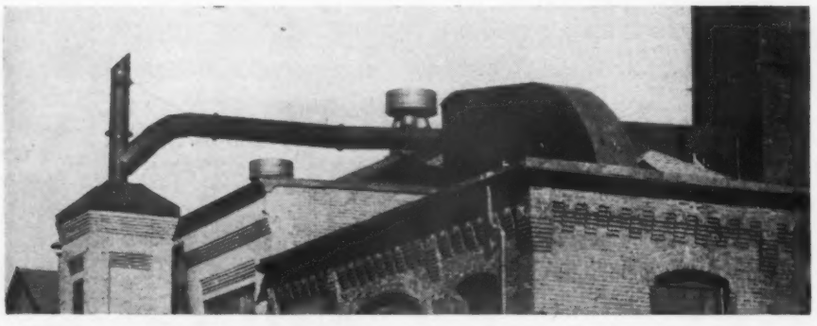
Formerly the boilers discharged their flue gases into a horizontal duct above the boiler battery, which delivered its output through a right-angled section terminating in a stack connection inside the station. Under the new layout, the three remaining boilers discharge their gases into a 3 x 5-ft., 5/16-in. steel plate duct mounted about 6 ft. above the roof, streamlined to connect with a right-angle turn section terminating in the stack about 20 ft. above the former chimney intake point. The natural draft continues to be satisfactory despite this change in level of entry, the stack being 110 ft. high and 4 ft. square inside. The new location of the flue above the roof level covers no other important area and is accessible for maintenance.

Exhaust of the Diesel unit may be discharged into the air about 30 ft. from the ground through a 12-in. pipe at the top of a Maxim silencer tower or into the stack through a 15-in. connection, according to the setting of hand control dampers accessible from the roof. Normally the stack exhaust is used in summer and the lower discharge point the rest of the year when adjacent residential windows are closed.

The plant rating is about 2,630 kw., there being three steam turbine sets in addition to the Diesel.



CLOSE-UP of new section of temporary boiler flue, supported by old 4-in. trolley T-rails



URGENT construction requirements met by installing temporary flue over power plant roof. Maxim silencer tower at left for new Diesel unit

Transformer Fusing*

2. How to Reduce Unnecessary Fuse Blowings

By H. L. LOWE
Ebasco Services, Inc., New York, N. Y.

Some operators have been able to decrease effectively fuse blowings on distribution transformers by employing transformer primary fuses of sufficient capacity to eliminate false blowing caused by lightning. This practice has proved satisfactory in many instances where secondary short-circuit currents have been heavy enough to blow the larger primary fuses. In other cases, where the magnitude of short-circuit currents are limited, such as by long secondary lines, the damage to a transformer by fault currents insufficient to cause blowing of the oversized primary fuse has been avoided by employment of secondary fuses. The justification of the use of secondary fuses for these cases is determined by the frequency and duration of secondary short circuits, which, in turn, are influenced by the physical hazards associated with the secondary lines connected to the transformer. In general, it would seem advisable to proceed cautiously in the omission of secondary fuses on transformers equipped with "oversized" primary fuses, although some operators have had considerable success with this practice.

One large operating company has employed transformer primary fuses of minimum size of 30 amp., type "N," without any secondary back-up protection, for several years and has

*This is the second of a series of articles which began in December 12, 1942, issue of "Electrical World."

HOW... are Ljungstrom Air Preheaters helping to increase the efficiency of synthetic rubber production?

✓In generating the huge quantities of steam required for power and process use, Ljungstrom Air Preheaters recover waste heat from the flue gases and transfer it to the combustion air being fed to the boilers. This increases the efficiency of combustion, raises the capacity of the steam generating units, saves fuel and critical materials.

✓In furnishing process steam at 1400 deg. F. or higher, using separately fired superheaters, Ljungstrom Air Preheaters also serve to assure maximum heat recovery and to improve combustion.

✓For cracking stills and other petroleum processes furnishing synthetic rubber constituents, high-temperature Air Preheaters recover heat from the furnace gases and permit a type of furnace design which cuts steel required for convection tube banks.

WHY..... are more Ljungstrom Air Preheaters being selected for synthetic rubber plants than all others combined?

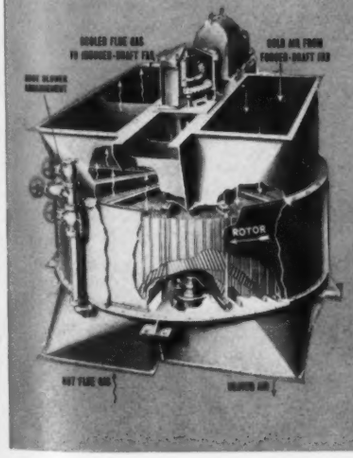
✓The Ljungstrom Air Preheater transfers heat from gas to air using only *one-half* to *one-third* the weight of steel required by other designs.

✓In addition to steel saved in the unit itself, there are additional savings in the supporting structure, due to the Ljungstrom's lighter weight and smaller size.

✓Continuity of operation, particularly in high temperature applications where gases at 1400 deg. F. and more may enter the unit, is a well proved advantage of the Ljungstrom.

✓Hundreds of these units in service at central steam stations, oil refineries and chemical process plants, give a groundwork of operating experience which means a *faster,* more assured solution of your gas-to-air heat-transfer problems.

HOW THE LJUNGSTROM AIR PREHEATER OPERATES



In the Ljungstrom, the heating surface is incorporated in a compact, slowly rotating cylindrical unit. It acts to "soak up" the heat in the gas chamber and then, upon rotation, to liberate it to the entering air. By means of this *continuous regenerative counterflow* principle, the maximum transfer of heat is obtained with minimum weight and size. One inch in height of Lungstrom heating surface is equivalent to one foot in height of tubular or plate surface.

THE SCORE

Recent wartime orders for Ljungstrom Air Preheaters include:

For Synthetic Rubber Production	21 units*
For Petroleum Refining	23 units**
For Ordnance Manufacture	14 units
For Other Chemical Processing Plants	4 units
For Metal Refining	4 units
For Steam Power Generation in War Prodution Areas	10 units

*including 6 units for use on separately fired superheaters

**including high-temperature units for cracking still furnaces

THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

experienced no noticeable increase in transformer failure. This experience coincides with and substantiates that of other operators who have found that transformer damage is not necessarily a function of the minimum size of primary fuse employed.

Much experience with failure of small fuses from mechanical injury, fatigue, corrosion, corona, lightning and other causes indicates quite clearly that primary fuse sizes smaller than 5 amp., and in some cases 10 amp., have very undesirable characteristics and in general should be eliminated. The increase of this minimum fuse size to some higher rating should probably be postponed until further experience indicates that such practice may be justified.

Self-Protected Transformers

Employment of completely self-protecting transformers, equipped with overload breakers on the low-voltage side and "weak links" on the high-voltage side inside the transformer tank, offers a means of protection involving no primary fuses. The so-called "weak links" are employed solely for disconnection of the transformer to clear the line in event of the development of a fault within the transformer. Transformers of this type are offered by practically all manufacturers at the present time. Where external secondary fuses or breakers are employed and primary fuse links are difficult or impossible to obtain, a rather crude "weak link" type of "home-made" fuse may be inserted in a suitable holder to give satisfactory protection against transformer failure. The primary "weak link" must be small enough to coordinate properly with main and branch line fuses to insure satisfactory performance of the distribution system by avoiding unintentional outages to remote parts of the circuit, but at the same time it must have sufficient capacity to maintain continuity except when a fault occurs in the transformer. The "weak link" could be made of any fusible metal, such as lead, tin or copper wire.

If a holder for the "weak link" is not available, the link could be suspended in the transformer lead by use of solderless connectors.

During the war emergency it may be advisable to depart from some of the normal practices previously employed in fuse replacement and to operate on a basis which will result in greatest saving of vital materials. For instance, it has been the practice of many operators to renew all three fuses on a three-phase transformer installation when only one or two fuses have actually blown. It appears that a conservation procedure for the "duration" would be to replace only the fuses which blow unless definite evidence of damage to the other fuse elements is indicated upon inspection.

In some instances it may be advisable to group the protection of transformers on a primary branch line, installing a single fuse in the place of several fuses to protect the primary feeder in case of short circuit at some point on the branch line. The secondaries of transformers connected to this branch could be equipped with secondary fuses, if necessary, for the protection of individual units against the possibility of damage caused by excessive secondary currents. This practice has been followed to some extent in certain rural areas where primary fusing of each transformer installation could not be economically justified.

•

Fittings Guide Cable Pull Line

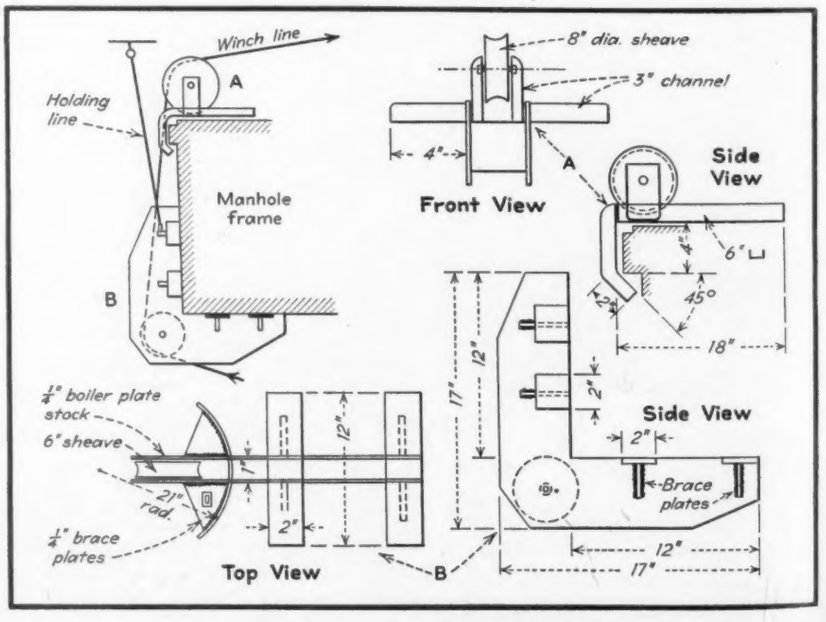
The usually awkward job of rigging a winch line to pull new cable into ducts has been simplified on the underground system of the Indiana Service Corporation, Fort Wayne, Ind., by the two fittings shown in the accompanying illustration. These fittings attach to the top and bottom of the manhole frame and carry sheaves that guide the winch line up and out of the manhole without interfering seriously with other operations at the manhole mouth, or within the manhole itself.

•

Controls Test Resistance Heat

When load resistances for meter testing are set underneath the testing tables they heat the testers' legs, a condition conducive to chilblains in winter and to excessive perspiration in summer. To eliminate these seasonal discomforts in the meter laboratory of the Philadelphia Electric Company the resistances were set up in the air just above the tops of the test panels. Then another difficulty was experienced. Testers discovered that the heat from the resistances mounted above the boards behind them was beating down uncomfortably on the backs of their necks and they stuck up pieces of cardboard to intercept the ardent rays.

But that solution was only a makeshift and not sightly in appearance either. A better one was quickly found; it was to inclose the resistance in a box of asbestos panels, open top and bottom to create a chimney effect, thus making the resistance a positive contributor to proper air circulation in the room.



FITTINGS at manhole frame guide winch line used in pulling power cable

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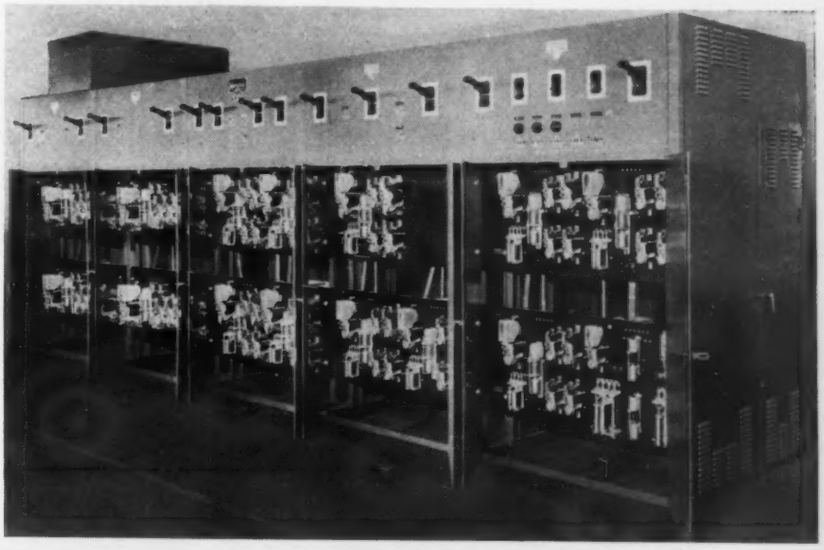

A recent Monitor Installation

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

HOW TO RECORD

UNDERGROUND SYSTEM FACILITIES

By S. A. OLSON
Electrical Department, Village of Freeport, L. I., N. Y.

By a few sketches and a few data on each sketch a small utility can keep a simple record of its underground system. Information will be readily available on occupied and unoccupied ducts, also for connections in manholes and transformer vaults. Distances are shown from center line to center line of manholes; then, knowing the dimensions of the manhole, the lengths of individual ducts and cables can be readily determined. Total lengths can be tabulated separately, and calculations are made according to the number of duct runs from a respective side of a manhole.

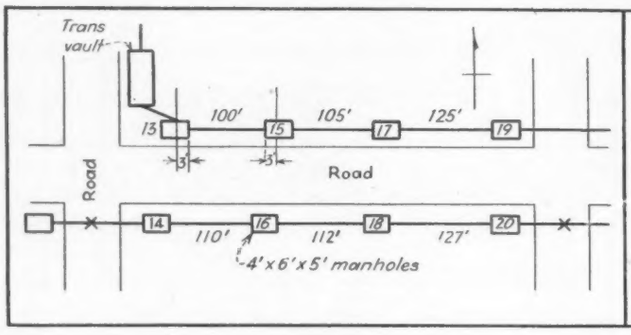

Fig. 1—Manhole and duct system

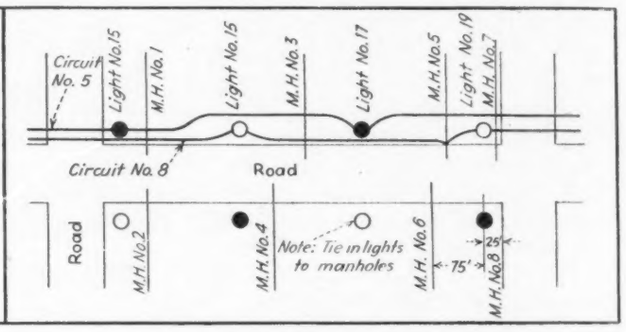

Fig. 2—Street-light circuits and outlets

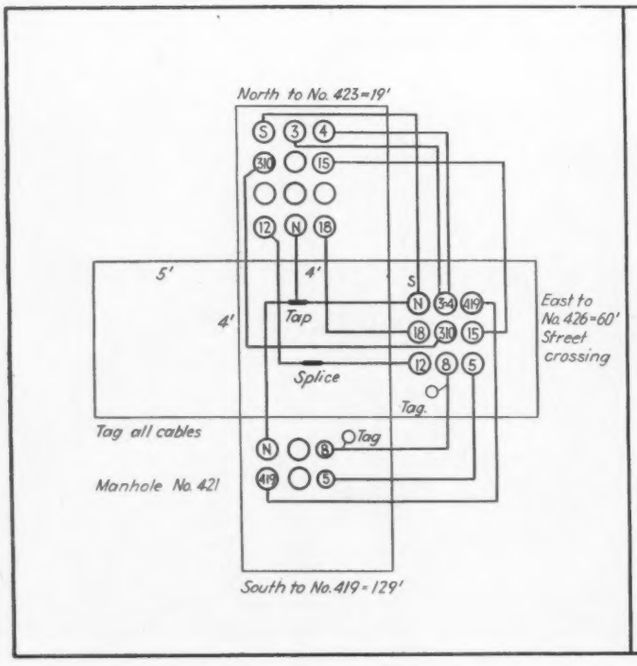

Fig. 3—Manhole with through-runs and taps

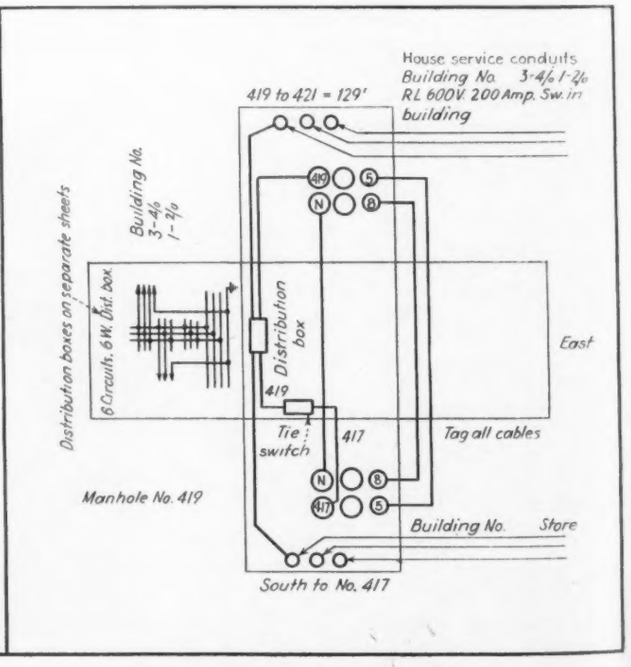

Fig. 4—Manhole with service connections

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2. LESS WASTE!"

OLIVER "SPEED-POINT" BOLTS

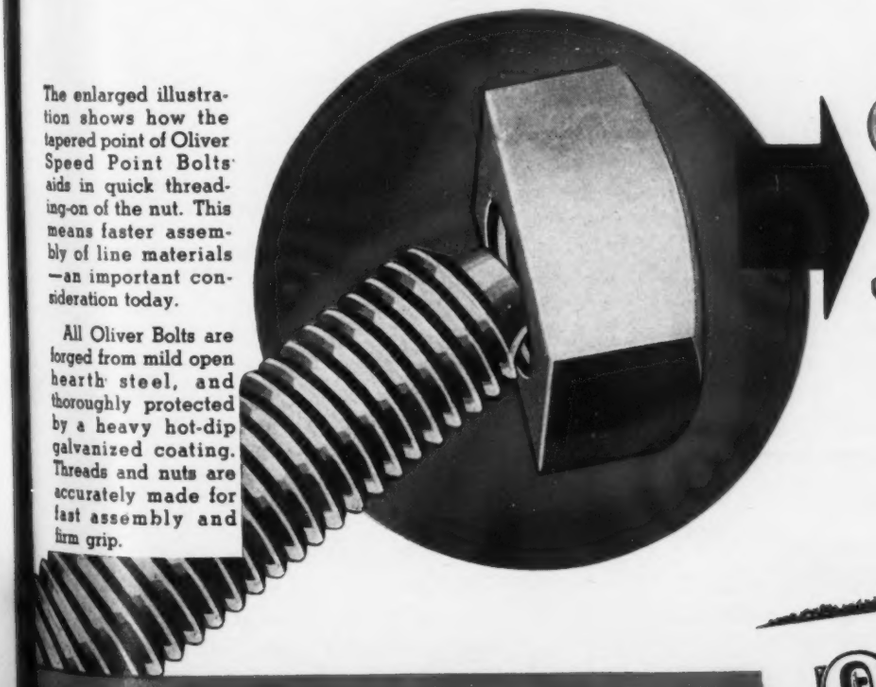
Help you meet both demands!

✓ **FASTER ASSEMBLY.** You will find assembly of pole line material faster when you use Oliver Speed Point Bolts, because (a) Nuts are threaded on more quickly from any angle (b) Speed Point Bolts drive faster.

✓ **GREATER SALVAGE.** Oliver Bolts may be driven out of old holes and used over again without rethreading because the Speed Point construction prevents "mushrooming" of the points and damage to the lead threads.

The enlarged illustration shows how the tapered point of Oliver Speed Point Bolts aids in quick threading-on of the nut. This means faster assembly of line materials—an important consideration today.

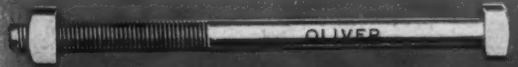
All Oliver Bolts are forged from mild open hearth steel, and thoroughly protected by a heavy hot-dip galvanized coating. Threads and nuts are accurately made for fast assembly and firm grip.



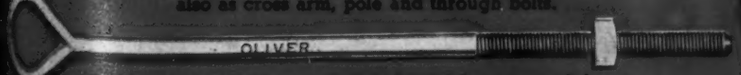
Double Arming Eye Bolts form an easy method for guying or dead-ending lines on double cross arms.

Double Arming Bolts provide an economical means of tying two cross arms together.

Oliver Carriage Bolts have square nuts, finished points and rolled threads, assuring good fit.



Oliver Machine Bolts are made in all sizes. Known also as cross arm, pole and through bolts.



Oliver Eye Bolts are drop forged from one solid piece of open hearth steel.

"Thimbleye" Eye Bolts have deep groove for seating the strand. Used without guy thimbles.

OLIVER
IRON AND STEEL
Corporation

Makers of Pole Line Materials Since 1894

PITTSBURGH, PENNSYLVANIA

Cooperating in War Production

Metallizing Repairs Turbine Shaft

At the Willamina plant of the Portland (Ore.) General Electric Co. there was an ancient hydraulic turbine of 200 hp. driving, by belt, a 150-kw. generator. A short time ago the old wheel appeared to be reaching the final stages of dissolution, so a consultation was held to determine its fate.

Fortunately the main trouble was only in the shaft. A coupling which had originally been shrunk on had evidently been loosened at some time and had then been keyed in place. The keyway was found to be enlarged and the key worn to a mere sliver. The resulting play had caused the end of the shaft to wear down. It was decided to build up the shaft and refinish it. It was accordingly brought in to Station L in Portland and the job done there.

The shaft at the keyway had been worn for a distance of about 10 in. longitudinally, and this portion was first built up by arc deposition until approximately required size. This build-up was approximately $\frac{3}{8}$ in. Next, the surface of this section was turned down on a lathe approximately 10 one-thousandths of an inch under finish size (20 one-thousandths under finished diameter). Grooves were then cut in this surface $\frac{1}{8}$ in. apart and $\frac{1}{16}$ in. deep. Applying a knurling tool, the metal between the grooves was "squashed," forming a roughened surface.

The final build-up was then accomplished with a "Metco," type 2E, metallizing gun, furnished by the Metallizing Engineering Company, Long Island City, N. Y. The work was done with the shaft revolving in the lathe and with the gun mounted in the tool holder with the automatic feed applied. It took about three hours to make the application, using spray iron, No. 11.

SHAFT built up with arc deposition and then prepared for finish job of spray metallizing

•

Paper Lining Keeps Spray Booth Clean

Three-sided inclosures, roofed with exhaust draft hoods and with small turntables in them, for spray painting, are familiar sights in meter repair shops. Familiar also are thick deposits of accumulated paint on the inside walls of these inclosures. But not in the meter shop of the Philadelphia Electric Company. It takes only an instant to clean out the spray-painting inclosures there. The inclosures are lined with paper, not firmly, but loosely pasted to the walls so that it can be torn out easily. By changing the paper periodically the spray booths are kept clean.

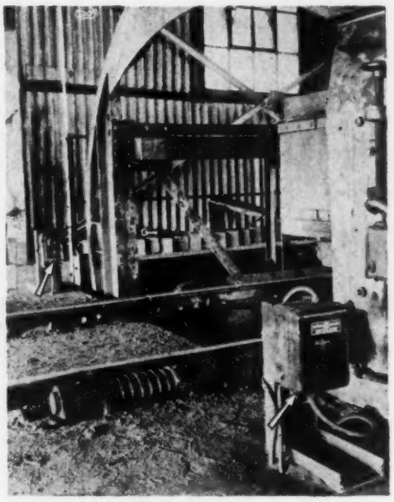
•

Phototube Guards Car Dumper

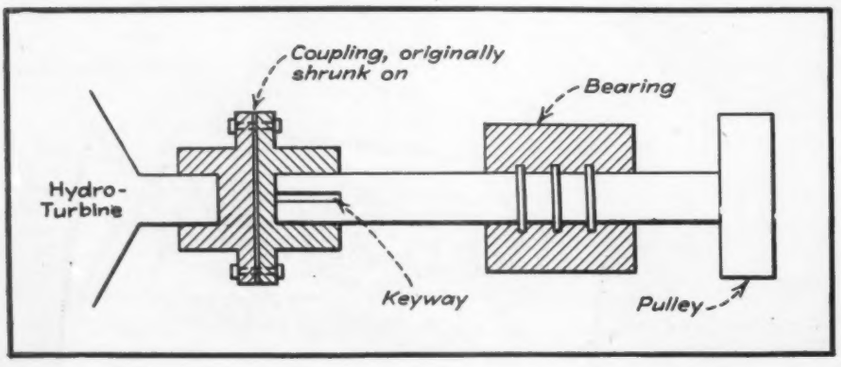
Empty cars leaving a dump are no longer overturned accidentally in an Ohio coal preparation plant. This is accomplished by the installation of an electronic device at the run-off end of the dump. Loaded coal cars are emptied by being rolled onto a rotary dump, fastened to the rails by a mechanical device, and then turned upside down over a chute. When empty the car is righted and moves off the dump by gravity.

It is essential that the dump does not revolve the next full car until the preceding empty one has moved off. Otherwise, the empty car will be turned over onto the floor. At intervals, however the plant experienced difficulty with this arrangement. The dump would revolve before the empty car has cleared. This usually happened because a particular car took too long to move off.

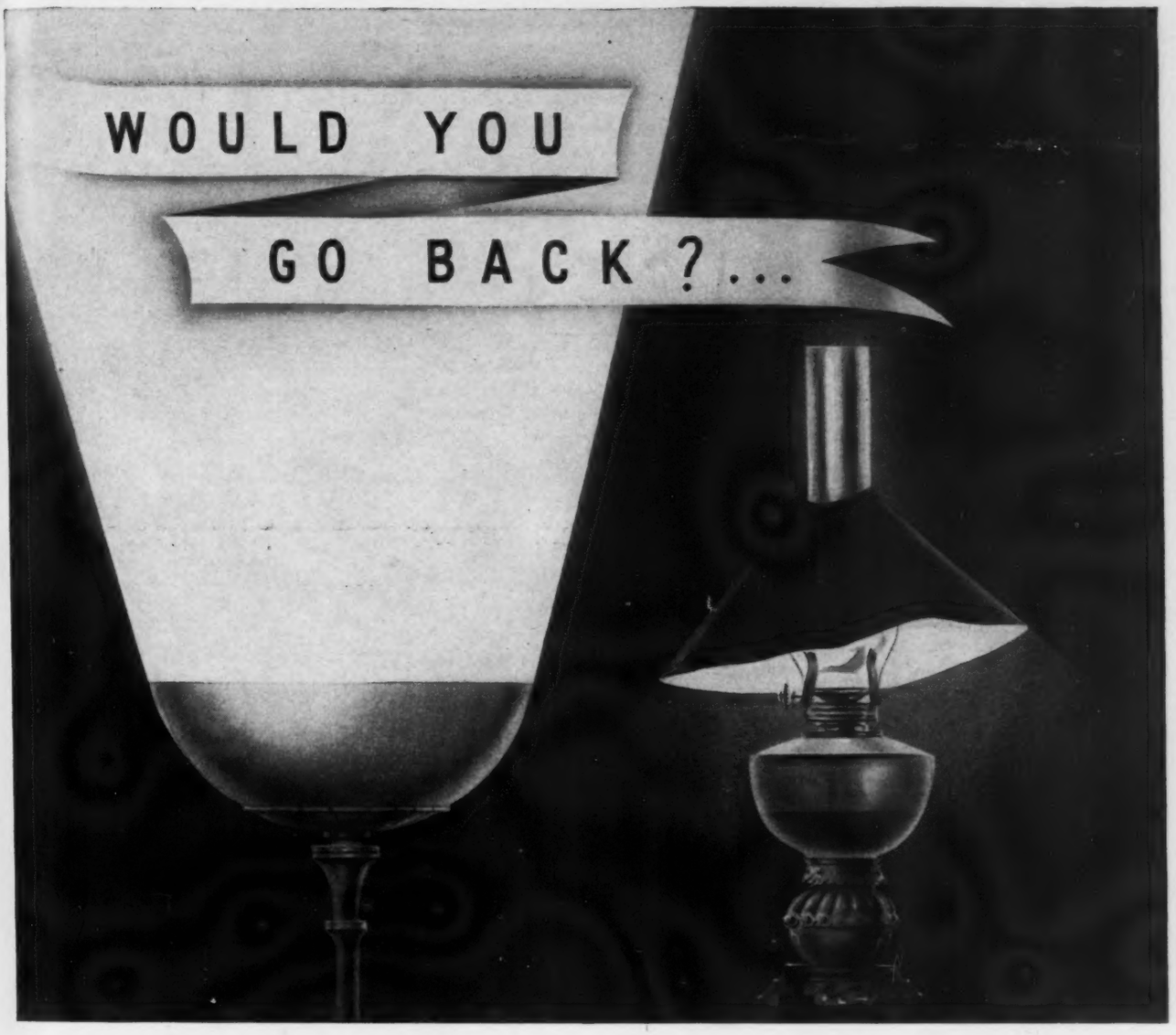
The difficulty was remedied when a General Electric photoelectric relay and light source were installed on opposite sides of the track at the "empty" end of the dump. Now the dump cannot revolve as long as the light beam between the light source and the phototube in the photoelectric relay is blacked out by the body of the empty car.



PHOTOTUBE equipment guards against accidental revolving of car dump



SHAFT AND KEYWAY in coupling of small hydro unit found loose and worn



A BETTERMENT . . .

Not a Substitute

Kerosene lamps were better than the tallow dip . . . The modern electric light is a BETTERMENT over gas for artificial illumination.

Who would want to go back to kerosene lamps?

No more will designers and engineers, who replace weighty—corrosive—costly—hard-to-get materials with engineered CONTINENTAL-DIAMOND NON-metallics, want to go back to the materials replaced.

C-D NON-metallics are not substitutes.

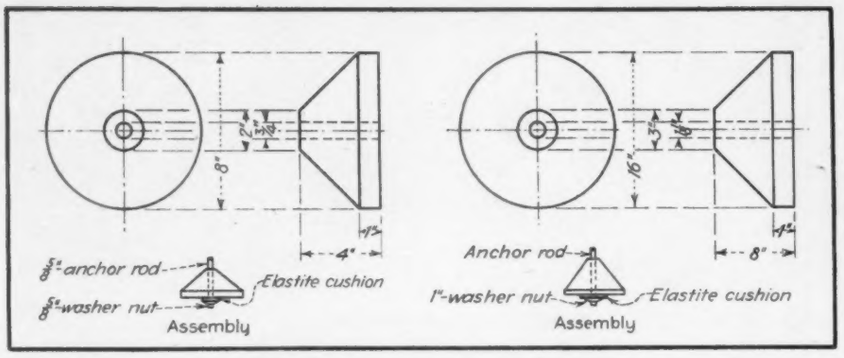
They should and can achieve BETTERMENT of product, process or performance. C-D NON-metallics are better suited to meet many of the material problems of either a war or peace economy than are many habitually used . . . now hard-to-get . . . materials.

C-D NON-metallics offer unique characteristic combinations. For example, DILECTO, one of five C-D NON-metallics, combines high Dielectric Strength, Corrosion Resistance, Light Weight (Specific Gravity 1.36), Resiliency, Moisture Resistance and Adaptability for High Speed, Accurate Fabrication on standard metal-working machinery. The other four C-D NON-metallics offer equally advantageous characteristic combinations.

Get acquainted with all FIVE C-D NON-metallics by sending for Bulletin GF-12. When you are ready to get down to brass tacks on specific problems . . . write, wire or phone us to send around one of our Research Engineers.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE



CONE ANCHORS of solid concrete replace steel units as conservation measure; save 11,000 lb. steel annually based on 1941 requirements; drawings show details of (a) the 8-in. and (b) the 16-in. concrete anchors; approximate mix by volume: 1 part portland cement, 2 parts torpedo sand, 1½ part ¾-in. screen stone

Concrete Cone Anchor Replaces Steel

By IRWIN ECKHART
Field Engineer
Wisconsin Electric Power Company, Milwaukee

To contribute as much as possible to the war effort by eliminating the use of critical materials in construction, the distribution engineering division of this company has developed, along with other substitute devices, a cone anchor made of concrete. The accompanying sketches show the details of the 8-in. and 16-in. concrete cone along with a picture of both.

For guy anchorage the company's long-standing practice has been to use 8-in. and 16-in. cone anchors, made of steel, for most construction. This type of anchor has proved both economical and satisfactory for the type of ground which we encounter around Milwaukee. Installation is simple. The cone is placed in a closely fitted hole with crushed stone tamped around it sufficiently tight to form a wedging action with the walls of the hole when the cone is under strain.

It is obvious, from the method of installation, that a cone anchor made of material other than steel, if sufficiently strong; and of the same shape, will function in the same manner as one of steel.

In order to substantiate preliminary calculations an extensive series of tests were made to check performance and arrive at an economical design for manufacture. Various concrete mixes, types of wire reinforcing, bearing washers and cushioning between the washer and the base were tried. The results obtained are as follows:

1. The concrete should develop a compressive strength of approximately 4,000 lb. psi. in 28 days. If it is of lesser strength the cone will fail due to entire breaking of the cone or the edges breaking off at the base. Edge thickness at the base should be a minimum of 1 in. or the edge will break off even for stronger concrete.

2. Various types of wire reinforcing do not appear to add any strength to this small body of concrete, but rather in some cases tend to create weakness. However, standard upset reinforcing rods were not tried, and these may give different results. Although reinforcing rods might be used, there is no economy in using steel where a small amount of additional cement will give the required strength.

3. Standard 2-in. and 4-in. square line washers at the base of the anchor without cushioning cup under the nut and thereby create an early break-up of the cone. These washers, used with a hardwood block for cushioning, give satisfactory results on test. Future studies are to be made of the possible performance of a wood block over a period of time in service. Rigid case washers at the base of the cone without proper cushioning tend to create spot loading on the cone base due to irregularity of the concrete surface and cause early failure of the concrete. With ¼-in. elastite cushioning these washers perform satisfactorily.

4. Creepage characteristics of concrete cones as expected are similar to steel cones. In clay soil the 8-in. cone will develop a holding power of 10,000 lb. before pulling out. The 16-in. cone in the same soil will hold 20,000 lb. before breaking or having excessive creepage. The tests were made within a few days after anchors were installed, which did not permit a settling of the earth around anchors which would occur after a long period of time.

The company is now manufacturing concrete cone anchors, without reinforcing, for use on the system as a substitute for steel. The accompanying table shows estimated comparative data for steel and concrete cone anchors based on our 1941 requirements.

Comparison Steel vs. Concrete Cone Anchors

	8-In. Cone Anchor (Steel)	8-In. Cone Anchor (Concrete)	16-In. Cone Anchor (Steel)	16-In. Cone Anchor (Concrete)
Weight each	5 lb.	7 lb.	31¼ lb.	48 lb.
Number used in 1941	1,770	.....	110	.....
Cost each	$0.524	$0.25*	$3.30	$0.50*
Total cost (1941 requirements)	927.48	442.50	363.00	55.00
Total weight steel (1941 req.)	8,850 lb.	885 lb.	3,465 lb.	200 lb.
Estimated cost saving per year	.....	$484.98	.....	$308.00
Estimated steel saving per year	.....	7,965 lb.	.....	3,265 lb.

* Estimated on basis of present information available.

•

More Steam—How?

16. Control Steam Temperature*

By ALFRED IDDLES
Application Engineer
The Babcock & Wilcox Company

Another important item frequently overlooked is the fact that the heat put into the steam for a 1,250-lb., 950 F. boiler may be as much as 25 percent of the total heat input to the unit. To do this the superheater has been placed nearer or partly in the furnace. It is therefore more sensitive to furnace conditions. Add to this the fact that the specific heat of steam at 1,400 lb. and 950 F. is only 0.6 of a B.t.u. per pound per degree difference. It takes only a small amount of heat to produce a degree difference in temperature in this range and the result is greater difficulty in controlling temperature.

Accurate control is of course desirable, but it is difficult to obtain. There is no denying the fact that it is much more important to be accurate in steam temperature since 950 F. is approaching the limit on available material both in the turbine and in the superheater. I am not minimizing the necessity for seeking this goal, but am pointing out that it can be done only by proper design and eternal vigilance, and the latter is up to the operator.

The steam temperature desired by

* This series began in the May 16, 1942, issue of "Electrical World," adapted from author's talk "What the Operator Wants to Know" to Steam Power Division, A.S.M.E., Metropolitan Section, March 25, 1942.

OEM Photo by Palmer

Steel Man with a Mission

. . TO KEEP THE ELECTRIC FURNACES MELTING

ALL of us—men or women—on the job or off it—are people with a mission these days. This war makes common cause for every one and spares no one.

The maintenance-man's job, atop an Allegheny Ludlum electric furnace, is no less essential than that of the crew who operate the furnace, nor than that of the fabricators who use the stainless, tool, valve or electrical steel it produces. Total war demands maximum cooperation on the supply fronts as well as the fighting fronts, and it asks also that every last bit of manpower and materials be used to maximum advantage.

Boiled down to a very few words, that simply means: *no waste—everybody help.* How can we help *you* to produce better and faster for war; to stop the loopholes of waste; and to plan your course in post-war production?

For your designers and technicians, complete and certified laboratory data on all Allegheny Ludlum alloy steels are available in "Blue Sheet" form. For your engineers and production men, our "Handbook of Special Steels" contains comprehensive and valuable information; and our "Elementary Discussions," covering Tool and Stainless Steels were developed particularly for training course and student use.

Write for any printed material that will help you; and if you need personal assistance, the services of our Technical Staff are at your command.

Allegheny Ludlum
STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA

A-8711 . . . W & D

a power plant designer is usually a matter of economics, but also involves an evaluation of the operating effect of the chosen temperature upon the steam-generating unit and upon the turbine and other related equipment, such as valves, piping, etc.

Principal variables affecting superheat temperatures are:

1. Cleanliness of furnace.
2. Available heat head to the radiant superheater.
3. Temperature of gases entering the convection superheater.
4. Cleanliness of the superheater.
5. Gas mass flow through the convection surface.
6. Feedwater temperature.
7. Character of ash and slag as it affects heat head in the furnace and absorption characteristics of radiant and convection superheater and boiler surface.
8. Design arrangement provided for controlling temperature.
9. Load on the unit.

To follow back to the ramifications that affect these items would add up to an imposing list, most of which are in the control of the operator, but some of which are controlled by load requirements, the factors which make purchasing agents buy fuel as they do, and the wisdom of the plant designer who chose the instruments and the combustion control equipment.

Changes in fineness of coal brought about by wear of pulverizers, performance of the soot blowers or the hand lancing program, the maintenance of the burners, the maintenance of the feedwater heating equipment and the quality of the feedwater treatment are examples of the items directly under the control of the operator which largely affect the results.

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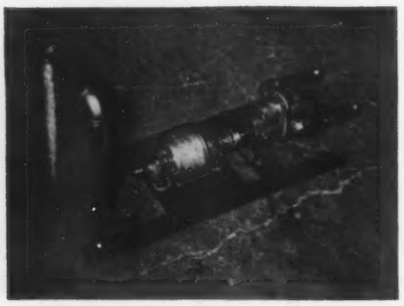
Portable Oil Pump

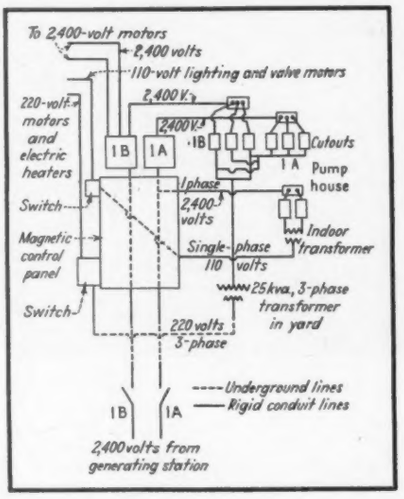


For pumping transformer oil in the field Nebraska Power Company, Omaha, has found the illustrated arrangement useful. To drive the pump a car or truck is jacked up, the pulley slipped under a rear wheel and the car let down until the rear axle housing rests on the horizontal pipe, which permits the tire to rest on the driving pulley. It's simple, but it works all right, we are told.

•

Centralized Control for Pump House

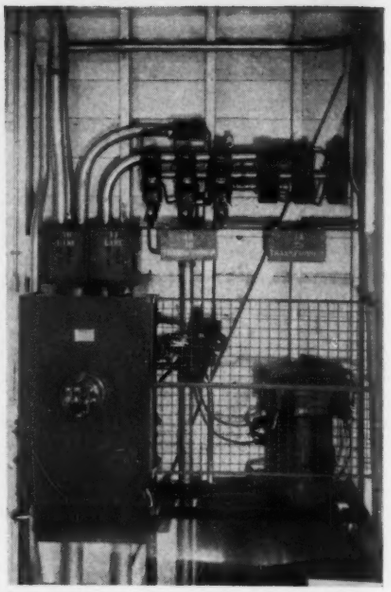
In the expansion and modernization of an Eastern steam plant it was necessary to build a circulating pump and screen house beside a tidal river to serve additional turbine equipment, two motor-driven vertical axial pumps constituting the main installation with corresponding traveling screens, motor-driven valves, screen



SCHEMATIC LAYOUT of power, lighting and heating circuits for control of condensing water supply equipment

washing pump and two electric heaters. The circulating pump motors were designed to operate at 2,400 volts with remote control from the power house and local control in the pump house using automatic starting equipment on a panelboard installation. Some of these motors operate at 220 volts and the valve operating motors and lighting at 110 volts. Pump house lighting circuits are operated at 110 volts.

To enable the 220-volt auxiliary motors and electric heaters to be operated from either of two 2,400-volt supply circuits running from the generating station to the pump house, a 25-kva. transformer located on a concrete pier in the yard outside the pump house has been installed with



VIEW of magnetic control panel, lighting transformer, conduit runs and switches in pump house

provision for energizing it from either or both of these feeders. The transformer secondary supplies 220 volts, three-phase energy to the pump house through an underground connection. The main 2,400-volt supply is brought into the house underground and carried to terminal boxes located above the magnetic control panel shown in the accompanying illustration. From here connections are made through conduit to hand-operated cutouts controlling a common supply to the yard transformer. Another tap from the 2,400-volt supply leads to a single-phase cutout serving an indoor transformer supplying 110-volt, single-phase energy for lighting and to motors operating the valves in the circulating water supply.

This centralized control equipment is located at one end of the pump house, protected by wire screening from casual contacts. A similar panel controlling the second motor-driven axial pump is located at the opposite end of the pump house. The general arrangement provides a compact set-up which saved wiring materials by centralization of junction boxes and switching and met the requirements of distributing three voltages for service inside the pump house with a relatively simple layout. Remote control of the main pump motors and principal auxiliaries from the power plant is easily effected, and no overhead wiring is installed outside the plant or pump house.

Pennsylvania Heavy Current Transformers

for

(1) Electric Furnaces
Melting and refining of:
Iron, steel, ferro-alloys, copper alloys.
Production of graphite and carbide.

(2) Rectifiers and Rotary Converters
Electrolytic production and refining of:
Copper, aluminum, magnesium, tin, zinc, lead, iron, sodium, hydrogen, oxygen, chlorine.
Electroplating • Transportation Systems.

(3) Electric Welding and Brazing Machines
Automatic pipe welding.
Fabrication of metal products.

(4) Electric Ovens
Heat Treatment
Annealing
Drying of paint and enamel.

Pennsylvania TRANSFORMER COMPANY

808 RIDGE AVENUE, • N. S., PITTSBURGH, PA.

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Combination Service Truck Cabinets

By E. A. MORRIS
Superintendent Customer Service Department, Dayton Power & Light Company

Formerly the Dayton Power & Light Company had three separate groups of employees for (1) electric service, (2) gas service and (3) a group which handled reconnects and disconnects. There was also one man who covered the city rechecking errors in meter readings. Now the city has been districted and crews trained to handle all three functions in each district.

They are provided with combination electric and gas service cars which carry in specific compartments (ten drawers and three bins) all the tools, fuses and fittings which they require. The upper right compartment is lined with asbestos so that still-hot appliances can be put in for delivery to the service shop for repairs. The large upper compartment contains a kit with heavy-duty fuses. Also in this large compartment is space for appliance cords, plugs, a loan-iron, pliers, fuse pullers, wrenches, etc. The upper-row drawers are 7 x 3 in., the two lower rows are 7 x 4 in. In the drawers are such supplies as the Wiggington voltage tester, small fuses, meter seals, tape, pipe hangers, meter swivels.

An 8-ft. Heavy-Duty Dual Safety (8B—Type D) stepladder with a platform height of 5½ ft. is carried over the cab and the tool-supply cabinet; it is used primarily for servicing ceiling heaters.

MODERN CABINET for Dayton's combination service crews is 32 in. wide and fits in the trunk space of a clover-leaf body. It was a prize-winning suggestion of Senior Serviceman Charles S. Stultz (right)

•

Transfer Refrigerant to Service Cylinders

Gas for servicing electric refrigerators can be purchased at a lower price in 50-lb. cylinders than in the 10-lb. containers that are included in the service man's equipment. Which is good economy if you have a means for transferring the refrigerant from the larger to the smaller container as is done in the appliance service department of the Durham (North Carolina) Public Service Company.

The large cylinder of liquefied gas is up-ended and clamped in a frame. Below and connected to it by a tube, including a valve, is an intermediate container with a tubular gage like the water glass of a boiler fixed to its side. Another tube with a valve connects to the small cylinder into which the refrigerant is to be transferred. The small cylinder is set in a brine tank which keeps it cold during the filling. The brine is cooled by an expansion coil connected to a compressor which is also used to evacuate waste gas from the system after a fill.

In operation the valve is closed between the intermediate container and the small cylinder and that between the intermediate and the large cylinder is opened, allowing the liquefied gas to flow into the intermediate container. When a sufficient amount, as indicated by the liquid level in the gage glass, has flowed down, the inlet valve is closed and the other is opened to allow the refrigerant to flow into the small cylinder.

Just out! NEW 16-PAGE BOOKLET!

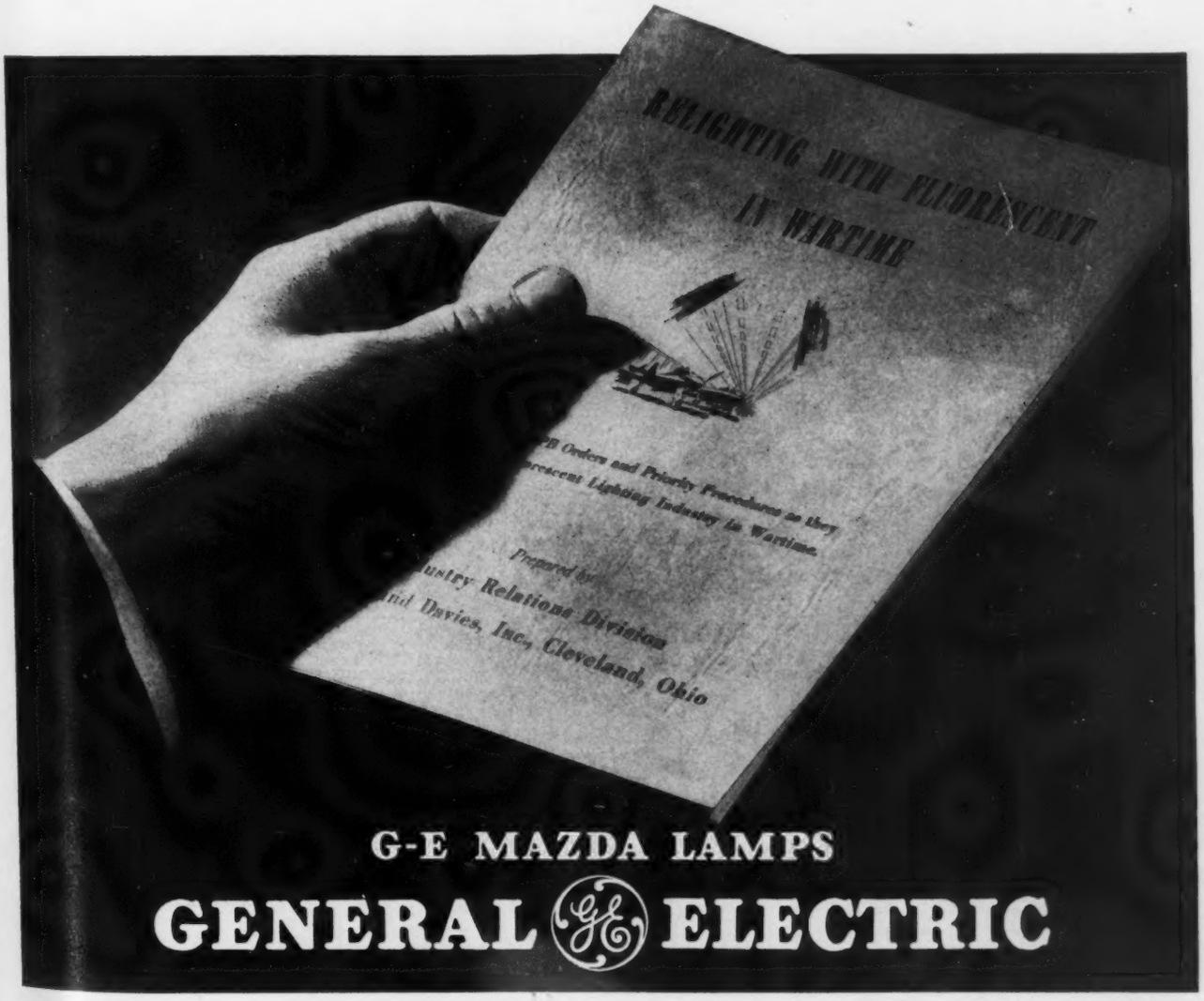
TELLS HOW TO OBTAIN FLUORESCENT EQUIPMENT FOR ESSENTIAL WARTIME LIGHTING NEEDS!

SIMPLY and understandably written, this new 16-page booklet, "Relighting with Fluorescent in Wartime", is a digest of WPB orders and priority procedures as they affect the fluorescent lighting industry in wartime. It is a working manual designed for the use of war industries, wholesalers, distributors, contractors, architects and utilities to help wartime buyers and users of fluorescent lighting obtain essential equipment.

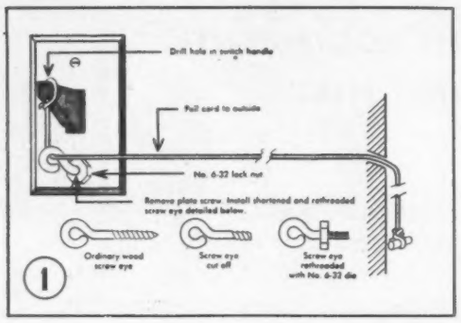
Among the subjects covered are the following: Why relighting jobs aren't handled like new ones . . . WPB's attitude toward lighting . . . How lighting has been restricted . . . Where and how fluorescent lighting fixtures may be sold . . . Filament lighting equipment . . . How to apply for a rating . . . "Do's and Don'ts" for war plants requesting new fluorescent equipment . . . Things to think about before requesting priority ratings on fluorescent fixtures . . . Why we have priorities on lighting fixtures.

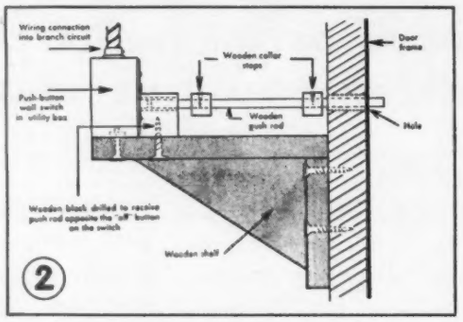
Also contains reproductions of necessary forms required for obtaining priority ratings.

Copies of this manual are available through your G-E Lamp Division office or from General Electric Company, Dept. 166-EO-1, Nela Park, Cleveland, Ohio.



Simple and Inexpensive Methods for Blackout Control of Small Store Lighting

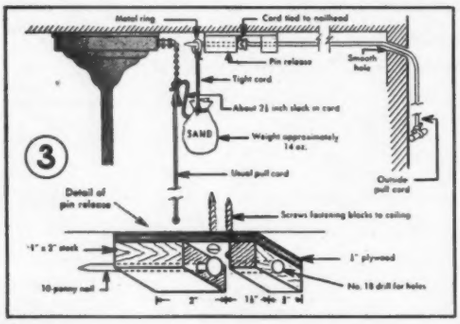

Drill hole in switch handle
Pull cord to outside
No. 6-32 lock nut
Remove plate screw. Install shortened and rethreaded screw eye detailed below.
Ordinary wood screw eye
Screw eye cut off
Screw eye rethreaded with No. 6-32 die
1

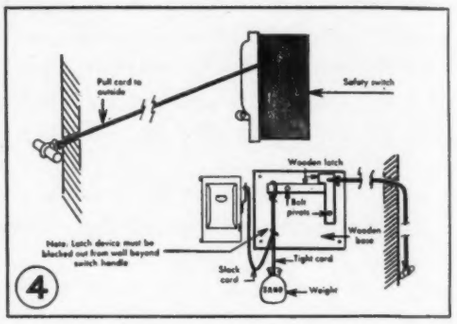

Wiring connection into branch circuit
Door frame
Wooden collar stops
Push-button wall switch in utility box
Wooden push rod
Hole
Wooden block drilled to receive push rod opposite the "off" button on the switch
Wooden shelf
2

These suggestions for outdoor controls to turn off lighting and signs of small stores during blackouts are published in a pamphlet distributed to commercial customers by the Chicago group of electric utilities, Commonwealth Edison, Public Service of Northern Illinois and Western United Gas & Electric.

1. Extending tumbler switch for outside control

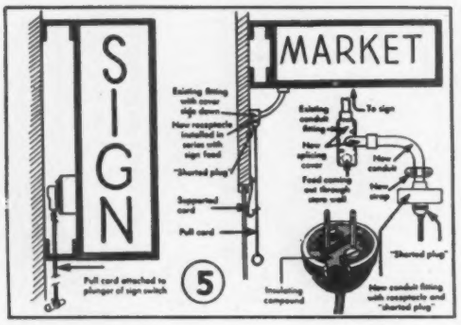
2. Outside control for push-button switch

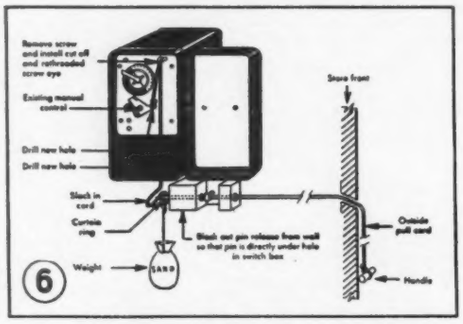




3. Pull-switch modified for outside control

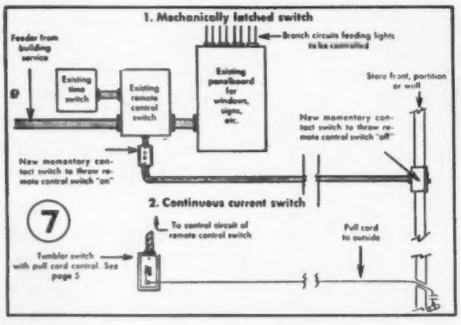
4. Device for extending control of safety switch

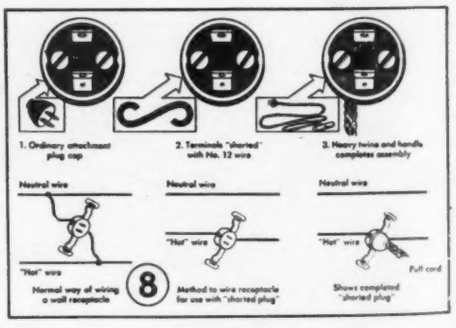




5. One-way controls for exterior electric signs

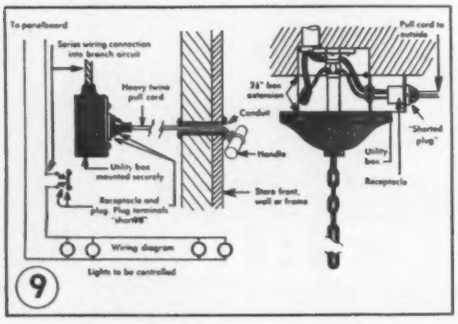
6. Way to extend manual control of time switch

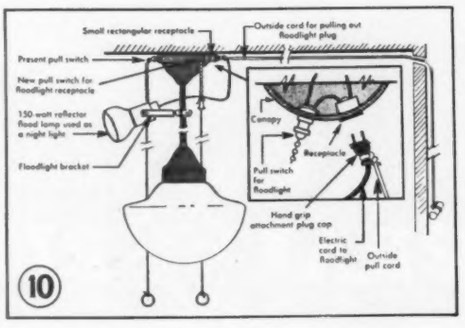

1. Mechanically latched switch
Feeder from building service
Existing time switch
Existing remote control switch
Existing panelboard for windows, signs, etc.
Branch circuits feeding lights to be controlled
Store front, partition or wall
New momentary contact switch to throw remote control switch "off"
New momentary contact switch to throw remote control switch "on"
2. Continuous current switch
To control circuit of remote control switch
Pull cord to outside
Tumbler switch with pull cord control. See page 5
7


1. Ordinary attachment plug cap
2. Terminals "shorted" with No. 12 wire
3. Heavy twine and handle completes assembly
Neutral wire
"Hot" wire
Normal way of wiring a wall receptacle
Method to wire receptacle for use with "shorted plug"
Shows completed "shorted plug"
Pull cord
8

7. Outside operation of remote-control switches

8. How to "short" a plug for use as a switch





9. "Shorted" plug applied to store-lighting control

10. Reflector flood lamp to serve as night light

MAILING LISTS THAT WORK . . .

McGraw-Hill Industrial Mailing Lists are a direct route to today's purchase-controlling executives and technicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

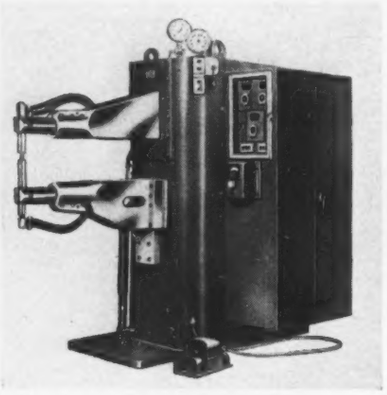
Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street New York, N. Y.

NEW EQUIPMENT

Welder

Rocker arm resistance welder has adjustable electrode tips which may be set at any angle without impairing their proper welding position, making it possible to weld unusual shapes of metals. All gages and dials are visible to the operator and are set on the frame of the machine.

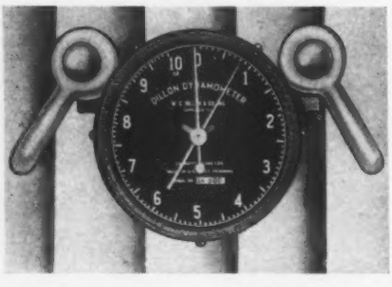


Type PMCR.2S16 rocker arm resistance welder; total pressure between electrodes for 100-lb. air line, 3,000 lb.; welding capacity, 0.080 in. plus 0.080 in., 24 ST. Alclad; throat depth, 34 in.; welding stroke, ½ in.; retraction stroke, 3½ in. **Sciaky Bros.**, 4915 W. 67th Street, Chicago, Ill.

•

Dynamometer

Suitable for use by telephone and power companies, new precision instrument makes it possible to tie in all lines at exactly the same tension. For corners, or at end leads where double guys are required, the device enables crew men to place strands at identical tension to distribute load evenly. Designed for laboratory work or field service.



"Model AN" dynamometer for measuring tension or applied stress. Individually calibrated to accuracy of 2 percent plus or minus. **W. C. Dillon & Co., Inc.**, 5410 W. Harrison St., Chicago, Ill.

•

Voltage Regulator

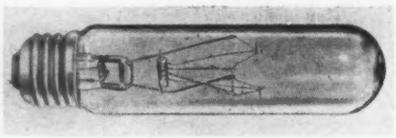
"GL-1" voltage regulator, suitable for 1, 2, or 3-phase alternators; 50-60 cycles; 110-120 volts or 208-240 volts. **Burlington Instrument Corp.**, Burlington, Iowa.

Applicable to individual small alternating-current generating plants having separate exciters, new voltage regulator will control individual generating units by using automatic cross-current compensation. Useful for portable applications, the device is not affected by vibration and tilting.

•

Welding Lamp

Made of special glass that resists penetration of hot metal particles, new type spatterproof lamp for welding and rough industrial service is said to withstand severe handling and to minimize lamp replacements.



"Spatterproof Lamp" has T10 bulb with medium screw base; sizes include 50, 75, 100 and 150 watts. **Radiant Lamp Corp.**, 260 Sherman Ave., Newark, N. J.

•

Controller

Reversing drum controller with built-in polyphase thermal overload unit. **Furnas Electric Co.**, 300 McKee St., Batavia, Ill.

Reversing drum controller has built-in polyphase thermal overload unit. In case of an overload in any phase, power is disconnected independently of the reversing part of the controller and an overload is signaled by a red indicator which projects through the top of the controller housing. Trip-free, solder-pot type overload unit cannot be reset and reconnected until drum handle has returned to "off" position.

Warning Device

Unit which provides audible and visible warning signals uses existing power lines to deliver such signals, relieving telephone lines. Operated by a control board attached to the carrier-current transmitter at the power station, the device is equipped with a transparent plastic dial which is divided into four colored sections, white, yellow, blue and red. In operation, this dial turns until the colored section corresponding to signal sent appears opposite a small window in the meter-like device. A miniature 110-volt lamp provides illumination to make visible the colored signal. Yellow, preliminary caution; blue, advance caution; red, air raid; white, all clear.

Air raid warning device; operates on 720-cycle carrier current systems. **General Electric Co.**, Schenectady, N. Y.

•

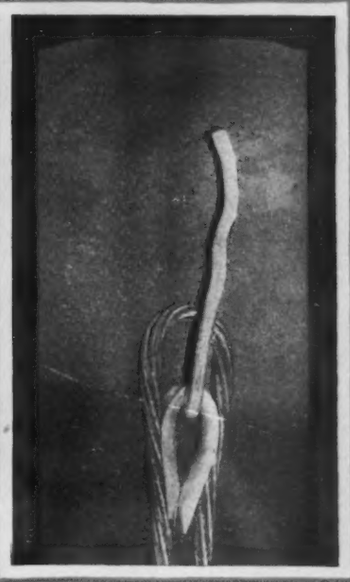
Wheatstone Bridge

"Type RN-1" Wheatstone bridge, equipped with external battery connections. **Industrial Instruments, Inc.**, 156 Culver Ave., Jersey City, N. J.

New laboratory instrument contains four resistance dials with nine positions each, covering 9 x 1, 9 x 10, 9 x 100 and 9 x 1,000 ohms with decade multiplying dials. The ratio resistance have a guaranteed accuracy of plus/minus 0.05 percent, while the resistance coils in the decades of the bridge are guaranteed to plus/minus 0.1 percent tolerance. Galvanometer is of the well-proven moving-coil type with sensitivity of one microampere per division.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

The Phantom Lineman

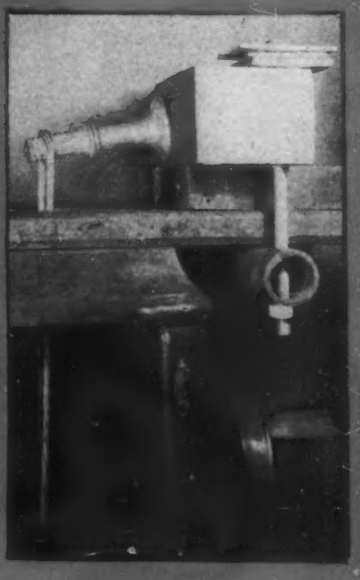


Wherever your power or communication system may serve; whatever its hazards may be and whether your crew is made up of one or hundreds of workers, the Phantom Lineman is also there working for you. He is on the pole, hard at work while your men are eating lunch and he is there when they are off duty recuperating for the next day's labor.

He is revealed for the first time by the accompanying photos showing how only a few of many hundreds of tests are carried out to insure the highest possible quality in Hubbard Pole Line Hardware.

For the Phantom Lineman is none other than old man "Test", the fellow who puts his finger on the bugs in a product. He is the one who checks the stresses, strengthens the weak spots, trys the practicability of the item and then stands by while it is in service on your lines.

He notes with satisfaction that his work has enabled your service to hold up through a severe winter storm, spring sleet or burning desert heat. He is the phantom who started his work in the Hubbard test laboratory and continues, shoulder to shoulder with your linemen.



"HANG THE LOAD ON HUBBARD HARDWARE"

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

The Aviation Industry needs Seed Money

THIS Victory crop is sweet—10,000 planes per month next year seem certain . . . 5,000 per month already passed . . . Worldwide average of four enemy planes knocked down for every American plane lost . . . Jap average five to one . . . Still better planes coming off the line.

And beyond the war, some people see a vast new industrial field opening up for America:

▶ Giant freight and passenger airliners, flying the airocean to every part of the globe, linking our cities in a traffic network that will obliterate time.

Family planes that will jump golfers to far off greens.

What are the chances for this exciting post-war crop of commerce and convenient travel from our aviation industry?

We think the chances are rather slim, and we ask you to take a serious look at the reason.

In our proper anxiety to prevent inflation and control war profits, we have passed tax laws that are taking away most of the "seed money" that aviation companies will need when the time comes to go it on their own in the post-war world.

▶ "Seed money" is that part of profit which is held for re-investment in a business to insure its growth.

"Seed money" will pay for research on new and better products. It will pay for retooling when post-war models are produced. It will pay for the study of methods to get the lower costs that widen markets. It will pay for setting up new distributors and dealers, and for hundreds of other activities that are involved in the *growth* of a business.

▶ American industry has grown on "seed money." It has been a national characteristic to re-invest most of our profits in development.

A dangerous confusion between personal profit (salaries and dividends) and re-invested profit (which we have called "seed money") has found its way into our taxing system.

The tax law, and government contracts, should allow American Industry to accumulate funds for the numerous tasks of post-war development.

A sum greater than the total now remaining after taxes will be needed, if we are to take advantage of the new opportunities that will exist after the war.

It is probably the oldest law in economics that enough of each crop must be saved to provide seed for future crops.

Ask your Congressman to see that this economic law is not disregarded in an effort to take excess profits out of war.

Reprints of this advertisement are available in handy booklet form.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET • • NEW YORK

Did you ever try to defend a PROFIT?

EVERY business man knows the difference between profit that is paid out to individuals and profit that is held for re-investment and future growth.

The trouble is that the public thinks of profit in terms of yachts, elaborate homes and costly debutante parties. They have learned to think that way because those things get the headlines.

The public does not know that far more profit money has gone back into American business than has ever been taken out for personal spending.

The McGraw-Hill Publishing Company is going to do its share in the job of explaining the difference between these two kinds of profit.

To be sure that the public does not confuse two different things that have always been called by the same name, we have developed the term "Seed Money."

"Seed Money" is explained in the McGraw-Hill newspaper advertisement reprinted on the opposite page. We urge you to read this advertisement carefully and apply its message.

There will be other McGraw-Hill advertisements on this vital industrial need. We hope, too, that other advertisers will adopt the term "Seed Money" and help by selling their employees in their own communities on the danger to living standards in taking away industry's ability to improve its plants and techniques.

* * *

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents... More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

Aviation—*(AMERICA'S OLDEST AERONAUTICAL MAGAZINE)—INFORMATION HEADQUARTERS FOR THE MEN WHO DESIGN, PRODUCE, OPERATE AND MAINTAIN AMERICA'S AIR SUPREMACY.*

American Machinist
Bus Transportation
Business Week
Coal Age
Chemical & Metallurgical Engineering
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Food Industries
Factory Management and Maintenance
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

AFFILIATED WITH BUSINESS PUBLISHERS INTERNATIONAL CORPORATION, PUBLISHERS OF BUSINESS AND TECHNICAL MAGAZINES FOR LATIN AMERICA, AND OVERSEAS CIRCULATION.

FIRE and how to fight it!

HOW OFTEN SHOULD EXTINGUISHERS BE RE-CHARGED?

Is your fire-fighting equipment in good condition—ready for a sudden emergency? Even the finest portable extinguishers cannot retain full effectiveness indefinitely. Some day one of your extinguishers may be called on to save your plant. Insure reliability of your fire-fighting equipment. Follow the simple rules charted below.

CARBON DIOXIDE	DO THIS ONCE EACH YEAR Weigh to detect leakage. If extinguisher shows loss of weight of less than 10% of rated capacity, stamped on label, nothing need be done. Recharge if weight loss shows greater than 10%.	WILL IT FREEZE? no
SODA ACID	DO THIS ONCE EACH YEAR Discharge and refill. Mix soda solution outside extinguisher, following manufacturer's instructions. Use lukewarm, not hot water. Wash all parts with water. Examine for clogging or corrosion.	WILL IT FREEZE? yes Do not keep outdoors in cold weather.
PLAIN WATER	DO THIS ONCE EACH YEAR Inspect by removing and weighing carbon dioxide cartridge. Replace cartridge if weight loss exceeds ½ ounce. Inspect hose and nozzle for clogging or corrosion, and check the quantity of water.	WILL IT FREEZE? See label for this information.
FOAM	DO THIS ONCE EACH YEAR Recharge. Mix solution outside the extinguisher according to manufacturer's exact directions. Wash all parts thoroughly with water. Test hose. Examine for corrosion or clogging.	WILL IT FREEZE? yes Do not keep outdoors in cold.
VAPORIZING LIQUID	DO THIS ONCE EACH YEAR Test by partially discharging. Pump a few strokes with extinguisher first aimed upward and then downward. Replace lost liquid, as furnished by manufacturer.	WILL IT FREEZE? no
DRY COMPOUND	DO THIS ONCE EACH YEAR Remove and weigh carbon dioxide cartridge. Replace if it shows loss of weight of more than ½ oz. for 12 lb. extinguisher or 1 oz. for the 20 lb. size. Check quantity of dry compound and determine that it is free-flowing.	WILL IT FREEZE? no
CARBON DIOXIDE SYSTEM	DO THIS ONCE EACH YEAR Weigh cylinders to check loss of contents. Blow out carbon dioxide lines. Check all releases, thermostats, tubing, switches, pull boxes and electric lines.	WILL IT FREEZE? no

MORE EFFECTIVE FIRE FIGHTING

Since December 1941 Walter Kidde and Company has had an unusual war job . . . to make products that save fighting men's lives. These products include high pressure containers for aviation use, special type built-in extinguishing systems, crash trucks and various flotation equipment.

Since we have fewer Kidde extinguishers* to sell, we are trying to make your existing fire-fighting units more effective.

If you want reprints of this series of advertisements, just write to

Walter Kidde & Company, Inc., 1228 West St., Bloomfield, N. J.

Kidde

*Formerly known as "LUX" extinguishers

NOTE: *Recharge extinguishers immediately after use, even though only partially expended.*

TECHNICAL LITERATURE

STEAM TRAPS—Instructions on installation and maintenance, installation of repair parts, trouble shooting, repair parts lists for free floating lever and fixed and compound lever traps, also a listing of the company's products, are contained in an eight-page bulletin, "Service Guide and Wartime Conservation Suggestions for Steam Trap Users." The bulletin, Form 155, can be obtained from Armstrong Machine Works, Three Rivers, Mich.

"GUIDING PRINCIPLES for the Selection of Reference Values for Electrical Standards" is the title of Proposed Standards No. 3 covering temperature, pressure, altitude, density and humidity of surrounding air or other medium. Copy may be obtained from the American Institute of Electrical Engineers, 33 W. 39th St., New York, N. Y.

LATHES—"Oiling the Lathe," a 19-page bulletin, outlines a regular procedure of oiling an engine lathe with proper lubricants at definite intervals. Numerous illustrations indicate lubricating points. Copy of Bulletin H-2 can be obtained from the South Bend Lathe Works, South Bend, Ind.

COPPER AND COPPER ALLOYS—Guidebook provides information on technology and properties of copper and copper base alloys, welding technique, manufactured forms, pipe and tube dimensions and weights, etc. The booklet, "Copper Guide," is offered by Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

CIRCUIT BREAKERS—Control diagrams, methods of tripping, interrupting ratings, closing and tripping currents, amount of oil required for 15,000-volt, 600 to 2,000-amp. rated Class 150-TCR-3 and 250-TCR-3 indoor oil circuit breakers are listed in Cat. 3350 obtainable from Roller-Smith Co., Bethlehem, Pa.

INSTRUMENTS—To facilitate the application of electrical instruments, their characteristics and principles are explained in "Instrument Extension Course No. 12." The 165-page book includes 200 illustrations and costs $2.50; orders should be addressed for the attention of C. R. Riker, Industrial Relations Dept., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING—Two manuals present a plan of training welders, an instructor's guide, and cover the organization and devices for shop control. "Dunwoody Arc Welding Job Training Unit" and "Dunwoody Gas Welding Job Training Unit," $1.25 each, can be obtained from American Technical Society, Drexel Ave. and 58th St., Chicago, Ill.

SEALING MATERIALS—Physical properties, examples of applications and listings of some government specifications for cork compositions, cork-and-synthetics, synthetics, cork-and-rubber, and fibrated leather are contained in an 8-page booklet, "Armstrong's Gaskets, Packings and Seals," available from Armstrong Cork Co., Lancaster, Pa.

LOAD CALCULATOR—Motor horsepower requirements for metal cutting operations on lathes, drills, planers and milling machines are simplified computations by the use of the Motorule. The calculator, similar to a slide rule, may be obtained from the General Electric Co., Schenectady, N. Y.

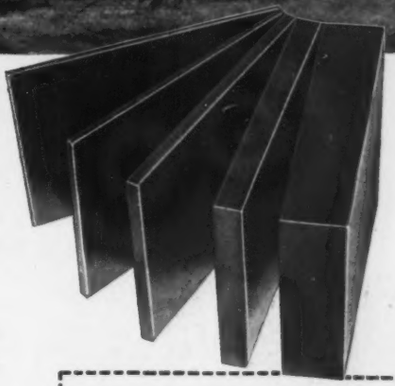
for ELECTRICAL INSULATION

In addition to its exceptionally good resistance to oil, this non-critical laminated lignin plastic is also highly resistant to water, grease, and dilute acids. It has excellent electrical and mechanical properties and is easily machined or fabricated.

Produced in black, satin, or molded sand blast finish—in 46-inch x 46-inch sheets, in thickness from 1/64-inch to 5/8-inch and 40-inch x 40-inch sheets in thicknesses over 5/8-inch to 2 inch. Other sizes can also be made available.

SUGGESTED USES: Base plates for mounting electrical equipment—Terminals and Electrical Connections—Switchboards and Panel Boards—Barriers—Spool Heads—Insulating Washers—Linings for metal-clad switchgear cabinets. Foundry Pattern Plates—Nameplates. Some manufacturers are using LIGNOLITE for constructing cabinets to house electrical equipment.

No critical materials enter into the manufacture of LIGNOLITE —It is, therefore, readily available for all applications.



SUPERIOR ARC RESISTANCE
HIGH DIELECTRIC STRENGTH
LOW MOISTURE ABSORPTION
HIGH-STRENGTH-WEIGHT RATIO

Send for Bulletin

showing properties, characteristics, and methods of fabricating and using LIGNOLITE.

Also, ask for a FREE sample for your personal inspection and test.

MARATHON CHEMICAL COMPANY
Div. of Marathon Paper Mills Co.
ROTHSCHILD WISCONSIN

NEWS ABOUT PEOPLE

R. D. Donaldson Joins Gibbs & Hill, Inc.

Roderick D. Donaldson, who recently became associated with Gibbs & Hill as head of a department to render advisory services to operating utilities (ELECTRICAL WORLD, December 19, page 5), has been associated with public utilities since his graduation from the college of engineering of Cornell University in 1907.

He obtained his early experience with Consolidated Gas, Electric Light & Power Co. of Baltimore and with the Potomac Electric Power Co. in Washington, D. C. From 1910 to 1918 he was power engineer with the United Gas Improvement Co., leaving to enter military service. After the war he entered the consulting engineering field and conducted an organization bearing his name, which specialized in indus-

Blank & Stoller

trial power plant economy and electric utility problems.

It was in 1925 that Mr. Donaldson joined the Utility Management Corp. as assistant chief engineer, subsequently being elected to a vice-presidency. In this capacity he supervised utility operations and was an officer and director of fifteen utility companies in fourteen states. He was responsible for company policies, including capital expenditures, operating expenses and procedures, sales promotion, advertising and public relations.

•

J. F. Gilchrist to Retire

After fifty-five years of service, John F. Gilchrist will retire on December 31 as vice-president of the Commonwealth Edison Co., Chicago, to become chairman of the board of the Chicago & Illinois Midland Railway Co., owned by Commonwealth. John W. Evers, Jr., secretary of Commonwealth Edison, will fill the vacancy created by Mr. Gilchrist's retirement.

•

▶ J. M. STUART, formerly supervisor of the underground department of the Dayton Power & Light Co., Dayton, Ohio, has been named manager of the electric division of the company.

▶ WILLIAM BIESTER, president of the Electric Construction Co., Philadelphia, has been appointed an alternate member of the American Standards Association's sectional committee on the National Electrical Code.

▶ CY WASHBURN, assistant chief engineer of the Jacksonville (Fla.) Water and Electric Engineering Department, has been appointed to the position of chief engineer to succeed R. L. MCCALL, who has entered military service. J. B. COX, an engineer in the utilities department, has been promoted to assistant chief engineer. The new appointments will be of a temporary nature, lasting for the duration of the war. Mr. Washburn is a graduate in electrical engineering of the University of Florida. He has been connected with the department for more than 17 years.

G. J. Taylor of Nela Park Takes New Post in East

George J. Taylor, industrial lighting engineer at General Electric Co.'s Nela Park, has been appointed to the position of wartime lighting engineer at the company's Atlantic division, New York. In his new position Mr. Taylor

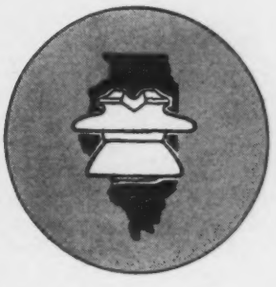
will work closely with the many government war production authorities who recently have been transferred from Washington to the New York-Newark area.

Born in Chicago in 1903, Mr. Taylor received his technical education at the Armour Institute of Technology and at the Massachusetts Institute of Technology. His first position was in a Chicago steel mill, where, between his studies and during vacations, he served as an inspector of electric motors. His first permanent position was with the former Cooper Hewitt Co. of Chicago. After two years in service and sales engineering for that organization he spent five years with the G & W Electrical Specialty Co., Chicago, as designer and estimating engineer. Mr. Taylor then moved to Hoboken, N. J., where he served for nearly seven years as head of G.E. Vapor Lamp Co.'s com-

ILLINOIS

PRIMARY
SECONDARY
and
SHACKLE
Spool
INSULATORS

★The need for dependable mechanical and electrical strength in Insulators of these types is adequately met by our Wet Process Porcelain. Plus this are the Illinois standards of manufacture that insure exact dimensions and uniformity. Our Wet Process Spool Insulators are made of the same materials and with the same careful workmanship as used in our high tension insulators. We are equipped to manufacture any special shape desired.



ILLINOIS ELECTRIC PORCELAIN COMPANY

Macomb, Illinois

mercial engineering department. He was transferred to the G.E. lamp department at Nela Park late in 1939.

•

Latin-American Service Wins Recognition

Westinghouse Electric & Manufacturing Co. has conferred its highest award on two subsidiary company employees for their part in promoting industrial development of Latin America. One of those receiving the award is American, the other an Argentinian.

The American, George W. Magalhaes, special representative of the Westinghouse Electric International Co., and an appointee of President Roosevelt to the Inter-American Development Commission, was honored for his work in furthering America's good neighbor policy. The Argentinian is Adolfo Alvarez, vice-president and general manager of the Compania Westinghouse Electric Internacional of Buenos Aires. Mr. Alvarez has directed sales of heavy electrical equipment throughout Chile, Uraguay, Paraguay and Argentina since 1937. His medal was mailed to him in Argentina.

•

▶ J. W. LISTER, for the past twelve years district manager for the Iowa Public Service Co. at Sheldon, has been transferred to Moville, Iowa, from which headquarters he will supervise operations in more than 20 towns. W. O. LUTHER has been made manager at Sheldon.

▶ CLAUDE A. MILLER, superintendent of transmission for the Bonneville Power Administration, has been made acting chief of the operations section to succeed Don S. Campbell, who has entered military service. Mr. Campbell was connected with the Washington Water Power Co. before becoming identified with the Bonneville staff in 1938.

▶ CHESTER N. CHUBB, president of San Antonio Public Service Co. from 1935 until the company was purchased recently by the city of San Antonio, Texas, has tendered his resignation as secretary of the City Public Service Board now in control of the properties. He will continue to be associated with the American Light & Traction Co., former owner of San Antonio Public Service Co., as vice-president. He will represent that organization in San Antonio until all matters in connection with the sale are consummated. Mr. Chubb will make his home at San Antonio, but expects that business will keep him away from the city much of the time for the present.

R. H. Bishop Named Sales Manager by Sylvania

Robert H. Bishop, formerly Eastern sales manager of the lighting division of Sylvania Electric Products, Inc., has been appointed general sales manager of this division. Mr. Bishop takes over

from Charles G. Pyle, who recently resigned to become managing director of the National Electrical Wholesalers Association.

Mr. Bishop brings to his new position many years of experience in sales and sales management work. He joined Sylvania six years ago. His headquarters will be at the company office in New York.

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▶ FLOYD R. HAYS, formerly of the Fort Collins commercial department, Public Service Co. of Colorado, has been transferred to Brighton as commercial manager to succeed M. F. CAMPBELL, who is now connected with the Sterling district.

▶ CECIL W. GUYATT, formerly assistant chief industrial engineer of the American Steel & Wire Co., has been named chief industrial engineer. JOHN S. CONANT has been made priorities administrator, at the same time continuing as general supervisor of production planning. LLOYD W. HACKLEY, formerly supervisor of production planning in the cold rolled department at the Cuyahoga Works in Cleveland, has been appointed assistant general supervisor of production planning for the entire company.

▶ THOMAS G. WHYTE, managing engineer of the lighting department, River Works, General Electric Co., has been appointed assistant to the manager, in charge of engineering. Mr. Whyte was born and educated abroad and entered G.E. employ in 1910 on the turbine test at Lynn. He was later transferred to transformer design work, and from 1917 to 1919 was located at the Pittsfield (Mass.) Works in that field. He returned to Lynn to devote his entire time to the study of street lighting transformers and associated equipment also engaging in research and experimental development. In 1922 Mr. Whyte was appointed transformer designing engineer and in 1929 was assigned to consolidate and co-ordinate the manufacturing and engineering activities of the lighting and transformer departments at Lynn, holding the managerial post until his current appointment.

▶ W. L. MANLY has been named manager of the feedwater treating department of the Allis-Chalmers Manufacturing Co. To his new position he brings an extensive knowledge of the all-important service problems in feedwater treating. As a field engineer, from 1937 to 1940, he serviced many types of plants throughout the Middle West from his headquarters in Chicago. With this background Mr. Manly joined the Milwaukee staff to direct service operations for the entire country. Since 1940 he has also been conducting practical research on industrial feedwater problems, based on his field observations.

▶ PHILLIP V. COLBURN has been appointed to the position of manager of the Cloquet division of Minnesota Power & Light Co., succeeding the late W. J. Wilkinson. Starting with the Minnesota Power & Light Co. as a young man in 1928, he was first employed as a groundman on the line crew. From this position he successively worked his way through the various positions of lineman, estimating engineer, line foreman, and in 1934 he was made division superintendent, the position he held at the time of his appointment as division manager.

OBITUARY

▶ RAYMOND J. MCCABE, vice-president in charge of sales of electrical materials for Indiana Steel & Wire Co., Muncie, Ind., died at his home in that city on December 6, after an extended illness. He was 55 years of age. Mr. McCabe spent 30 years with Western Electric Co. and Graybar Electric Co., Inc., before joining Indiana Steel & Wire Co. in 1938. Just prior to his association with Indiana Steel & Wire Co. he was New England district manager for Graybar in Boston.

▶ ARTHUR R. KELLEY, consulting engineer of the Southern California Edison Co., died, of a heart attack, on October 8 at his home in Santa Monica. He was 64 years of age. A business career in

private engineering and as an engineer with the California Railroad Commission preceded Mr. Kelley's affiliation with the Southern California utility in 1920 as engineer of estimates and valuations. In 1926 he was appointed valuation engineer and was consulting engineer at the time of his death.

▶ EDWARD G. WATKINS, 77, founder and president of the Simplex Time Recorder Co., Gardner, Mass., and holder of a National Association of Manufacturers' medal for contributions to this field, died in that city on December 15.

▶ WILLIAM L. MAURAN, 78, who was identified with the development and administration of the Laconia (N.H.) Electric Lighting Co., and was president of the former Westerly (R.I.) Light & Power and Claremont (N.H.) Power companies before their incorporation into other systems, died at Wakefield, R.I., on December 6.

▶ LESTER E. FLINT, 60, formerly an executive assistant in the New England Power System with headquarters at Boston, Mass., and for the past year treasurer of the Boston & Albany R. R., Boston, died suddenly on a Boston bound bus after leaving Weston, Mass., on December 12.

▶ FREDERIC C. BLANCHARD, formerly with the Ashcroft Manufacturing Co., Bridgeport, Conn., and since then vice-president and chief engineer of the Rivett Lathe & Grinding Co., Brighton, Mass., died at Brookline, Mass., on December 9. He was well known in the field of lubrication engineering.

▶ FRED I. WOLTZ, who has been associated with the E. A. Wilcox Co., industrial engineers of San Francisco, for approximately four years, died in that city on November 27. Early in his career he was connected with the Wagner Electric Co., St. Louis, and then, entering the utility field, he joined the Great Shoshone & Twin Falls Water Power Co. (since absorbed by Idaho Power Co.) at Twin Falls, Idaho. Subsequent connections followed with the Union Gas & Electric Co., Cincinnati; Central Hudson Gas & Electric Co., Poughkeepsie, N. Y.; General Engineering & Management Corp., New York, and with the utility properties at Easton, Pa. He then joined E. A. Wilcox Co.

▶ GEORGE W. LONGWELL, merchandise manager of the Ohio Edison Co., Akron, for more than eleven years, died in St. Thomas Hospital in that city on December 4, following an illness of several months. He became associated with Ohio Edison Co. in 1931, joining that utility after a connection with the Commonwealth & Southern Corp. in Jackson, Mich. A native of Paw Paw, Mich., Mr. Longwell had been connected with public utility merchandising and new business activities for more than 25 years. His first employment was with Consumers Power Co. at Kalamazoo, Mich., in 1916 and from 1918 to 1921 he was located at Battle Creek. He spent the next five years as store manager for Central Illinois Light Co. at Peoria. Returning to Jackson, he became an assistant to L. R. Parker, in charge of merchandising operations of the predecessor companies of the Commonwealth & Southern Corp.

▶ CLAUDE I. GRIMM, head engineer, U. S. Engineering Department, North Pacific Division, Portland, Ore., since 1933, died suddenly on December 1, in his fifty-seventh year. Mr. Grimm was supervising engineer for design and construction of the Bonneville project and numerous flood control dams in Washington and Oregon. He was consultant on the California state water plan from 1930 to 1933 and on the St. Lawrence power and navigation project international section since 1940.

▶ WILLIAM R. KALES, structural steel engineer, died in his office in Detroit on December 3, after a heart attack. He was 72 years old. He was president of Whitehead & Kales Co., which fabricated and erected the structural steel in the Ford Willow Run plant. Mr. Kales served on the Detroit Public Lighting Commission from 1906 until 1912. He was a member of the Detroit City Plan Commission for sixteen years and was its chairman in 1925. He resigned two years ago. Mr. Kales was a past-president of the Detroit Engineering Society and was a member of the American Society of Mechanical Engineers and the American Society of Civil Engineers.

▶ JOHN H. WILLIAMS, deputy chief electrical engineer, Manchester Corporation Electricity Department, England, died in July, 1942. Born in Croydon, England in 1876, he began a 30-year affiliation with the British Thomson-Houston Co., Ltd., in 1900, serving on the company's outside construction staff in Hull, Huddersfield and Nottingham until 1912. In that year he was appointed to the London staff, where he remained in charge of all construction work for the British Thomson-Houston Co. in the London district until 1920. He then was transferred to Manchester as district manager of the North-West England district, and in 1930 he left the company to become deputy chief engineer to the Manchester Corporation Electricity Department. This position he held until his death in July, only three months before he was to have retired. He was a member of the American Institute of Electrical Engineers, Institution of Electrical Engineers (British) and the Institution of Civil Engineers (British).

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on 000 to 1,500,000 C.M. cable with

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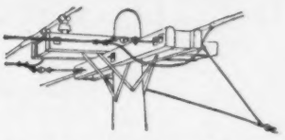
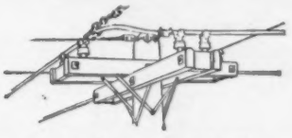


Shows how strain caused by right angle taps can be relieved



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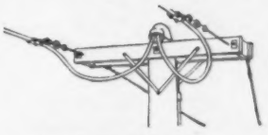

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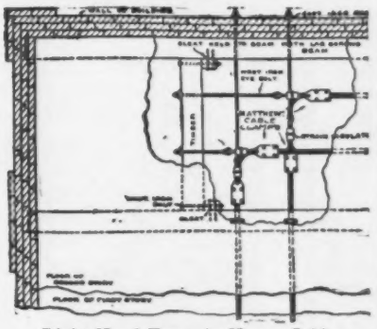
Hundreds of thousands of these Clamps have been sold.

Every order for 000 to 1,500,000 C.M. Cable should include an order for Matthews Cable Clamps for every corner or deadend.

Write for Bulletin C.



Right Hand Turns in Heavy Cable

W. N. MATTHEWS CORPORATION

ST. LOUIS, U. S. A.

MANUFACTURING-MARKETS

Distributors Urged to Help Uncle Sam

Electrical distributors face a critical outlook which must be met by increased participation in governmental affairs if their place in the industry is to be maintained, declared Charles McKew Parr, senior electrical consultant distributors' division, WPB, at a meeting of the Electrical Manufacturers Representatives Club of New England in Boston December 14. About 400 members and guests attended, and after Mr. Parr's address, Harry Stevenson of the WPB discussed the raw material and supply situation from the priority standpoint as this affects the electrical wholesaler.

Describes Government's Problem

Mr. Parr, a distributor of many years' experience who has recently been elected a member of the Connecticut Legislature, pointed out that many of the difficulties encountered by wholesalers under governmental restrictions resulted from the speed with which the Federal set-up to meet war conditions took place, and also from the lack of top-flight industry leaders in Washington. Every effort has been made by the government, he said, to establish regulations by experts after consultation with trade representatives, but in many cases the government has been obliged to carry on this work with second or even third-rate talent. Industrial leaders have been loath to part with their ablest men for Washington service, but today "Uncle Sam is an 80 percent silent partner in all business," Mr. Parr asserted. This means that business and industry must reconcile themselves to continued regulation and supervision, and this must be made successful by taking an honest and conscientious part in politics, electing able men to office and seeing to it that government shall be well administered.

The speaker predicted that government would dominate business after the war through bureaucratic organization in both federal and state areas no less than at present. An economic revolution is in progress and since bureacrats will sit in with business and industrial executives, private management will not have its say alone to the degree seen in the past. By and large, the speaker averred, American business has made few sacrifices of its higher personnel to help man government organizations, and when "culls" and second-raters become established in government, complaints increase. The WPB has persistently invited industry to send its best men to help its work, but the response has been inadequate to date.

Mr. Parr said that it would be well-nigh fatal to the war effort if the distributor should be abolished. It would be utterly impracticable to maintain the resulting hundreds of local stocks of material running into thousands of items were the distributor to go out of business. The manufacturer cannot possibly serve local markets alone in the multiplicity of demands from military and civil establishments scattered about the country, and the distributor is performing a valuable service here. The latter effects a real economy in our competitive system and does far more than merely to accumulate a stock of critical material. His understanding of regional and local conditions exceeds that of the manufacturer and his functioning tends to minimize the accumulation of overstocks and to guide military purchasing in a way to avoid top-heavy commitments by the army and navy. Even at best, some badly needed material is likely to remain in warehouses because ordered by inexperienced officers of the armed forces.

Mr. Stevenson pointed out that every man in the distributors' WPB electrical

HEADLINERS AT BOSTON MEETING—L. to r., C. McKew Parr, senior electrical consultant distributors' division, WPB; E. K. Haller, president Electrical Manufacturers' Representatives Club; Harry Stevenson, senior analyst, distributors' division, WPB

division has been a wholesaler, and declared that the distributor is as important to the war effort as is the airplane factory. He explained the necessity for filling out WPB forms in order to obtain properly allocated material, the system of supplies control now in use, relation of inventories to war demand, and method of allocating material to specific cases. Certain items like fuses must be sold without priority orders to retailers, because of their vital importance to the public. If distributors decline to sell these, the government will step in and take over the job. The controlled materials plan scheduled to go into use April 1, 1943, was reviewed, this to be applied to copper, steel and aluminum. WPB rules now lie at the very heart of industry and should be understood by executives everywhere.

•

Contractor Named in WPB Suspension

Paul C. Norwitt, operating under the trade name of General Refrigerator Corp., San Francisco, will be denied priority assistance and allocation of critical materials for the next three months, following violation of Priorities Regulation No. 1, according to a WPB announcement.

Suspension order S-173 charges that Norwitt improperly extended A-1-a preference ratings received by him, on orders for 24 refrigerators, to obtain 10,800 feet of copper tubing and 151 electric motors despite the fact that only 576 feet of copper tubing and 24 electric motors were necessary to fill orders of his customer.

•

Lincoln Welding Course

A special intensive five-day welding production course will be held in Cleveland, Ohio, the week of January 11 at the plant of the Lincoln Electric Co. Organized for foremen, supervisors, production engineers, superintendents, managers and all executives interested in greater welding production, the course has been planned to answer the urgent need for welded ships, guns and planes.

•

Square D to Get "V" Loan

Square D Co. has completed arrangements with the National Bank of Detroit and participating banks for a regulation V loan of $10,000,000, F. W. Magin, president of Square D, has announced. The loan is made to provide additional working capital required for the financing of government war production contracts.

HERE'S AN OLD TRADEMARK WITH A NEW PRODUCT

Your friend "Long Life"* now brings you ARTKRAFT Hot Cathode Fluorescent Lighting!

● Lamps guaranteed 3,000 hours (Rated 5,000 to 6,000 hours)...No starter switches ...Operates efficiently at 85 to 135 volts...Don't confuse with so-called quick lighting high voltage systems or cold cathode lighting.

SIGNS* OF LONG LIFE

This registered Trademark of The Artkraft Sign Co., the world's largest manufacturer of all types of signs, (now engaged 100% in war work) has always kept good company. Artkraft for years has served the outstanding names in American business —such has J. C. Penney Co., U. S. Tires, Pittsburgh Paints, and Shell Oil to name only a few.

Artkraft, with its four affiliate plants occupies almost a half-million square feet of floor space and employs 1600 craftsmen. This strong institution is your permanent assurance of ready lamp replacements.

WHOLESALERS:
Write for our proposition.

FIXTURE MANUFACTURERS:
Write for details on constant voltage manufacturing license.

Here's Why They're Switching To ARTKRAFT

- 3,000-HOUR LAMP GUARANTEE. Rated 5,000 to 6,000 Hours.
- NO STARTER SWITCHES. Artkraft resonant starting eliminates this trouble-maker.
- CONSTANT VOLTAGE POWER PACK. Gives efficient operation at 85 to 135 volts. Can also be used on 220— and 440-volt systems, single or three-phase. Cannot short circuit the line.
- 100% POWER FACTOR at rated voltage. 98% or over within 85 to 135-volt range.
- "EASY MOUNT" LUMINAIRE ALLOWS INSTANT REMOVAL WITHOUT TOOLS, FOR CLEANING NON-FERROUS REFLECTOR OR LAMPS.
- CONSTANT TEMPERATURE HOT CATHODES. Light at 40° below zero, operate efficiently at low temperatures.
- STROBOSCOPIC (FLICKERING) EFFECT REDUCED.
- MORE LIGHT FOR THE SAME CURRENT.
- FIELD TESTED UNDER ADVERSE CONDITIONS FOR OVER FIVE YEARS.
- MODERATE FIRST COST. RADICALLY REDUCED MAINTENANCE COST. Lamp replacements are less frequent, starter replacements eliminated, ballast replacements unknown, man-hours saved by making these replacements unnecessary.

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Please send without obligation your new profusely illustrated circular F102. Have qualified Artkraft Fluorescent Lighting Engineer call.

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LONG LIFE DEPENDABILITY

Field Reports on Business

Favorable reports are being received from most industrial areas, with some quarters showing new peak levels. Though industry is working at top speed on war orders, the trend in the electrical equipment market is downward. Consumers' buying continues at a record-breaking pace.

NEW ENGLAND

While the trend in the electrical equipment market is definitely downward, New England industries are operating at top speed on war orders. Government buying is confined to small orders for control apparatus, wiring supplies, radio and communication. Engineer contracts for a few temporary wooden buildings needing only the minimum in lighting were awarded last week for Massachusetts locations.

Negotiated contracts recently released include an unspecified number of airplane engine parts to a Connecticut manufacturer; part of a 2,000 (vacuum receiving) tube order to a Massachusetts manufacturer; several small lots of shore and marine use magnet wire, and an electric cable order to a Rhode Island manufacturer.

Some of the non-ferrous metal-working plants in the southeastern Massachusetts district and Rhode Island have been given sizable orders for service insignia, while leather, cloth and rubber goods plants have received encouraging awards. Tenders have been submitted for a widely diversified volume of electrical equipment which includes resistors, non-metallic sheathed cable, dry batteries, spare parts for submarine propulsion, and small portable ventilating units.

Wiring contracts in the Boston area reported for the past month show a rapid falling off due to the completion of factory building and changes undertaken during the fall. Leominster, Mass., is considering the installation of air raid sirens on poles of the local utility. Public Service of New Hampshire sold $491,050 in electrical appliances the first ten months of 1942, but inventories are fast dwindling.

NEW YORK

The shortage of critical materials which has resulted in the virtual curtailment for the duration of consumers' durable goods bids fair to catch up with the retail trade in no uncertain fashion, following the Christmas buying season.

Two significant indicators, released last week, point up the trend. For the fourth consecutive month merchandise inventories of New York department stores dropped sharply and, at the end of November, stood at only 16 percent over those of the corresponding period last year, according to the Federal Reserve Bank of New York. After the Christmas season retailers predict that stocks will be on a par with the '41 figures. When inventory controls are put into effect next year the ratio to 1941 is expected to be on the minus side.

In the same month of November department stores had an 8 percent increase in sales. Figures for the latest week show a 16 percent rise over the corresponding week last year and a 13 percent rise for the latest four-week period, according to Federal Reserve Board estimates. Add to that the figure of $26,000,000,000 of individual savings in 1942—almost double the 1941 figure and triple the 1940 figure—and you have a combination which points to constantly increased consumer spending, constantly decreasing stocks, and little prospect of replacements.

Engineering construction volume for the week totaled $75,539,000, a decline of 11 percent from the previous week's figure, but a rise of 13 percent over the corresponding week a year ago. Current week's total brings the '42 volume to $9,196,157,000, a 58 percent increase over the '41 period.

CHICAGO

Comparatively small change was recorded in electrical business last week. Most manufacturers report a gradual decline in new orders over the past several weeks. This is due primarily to a decline in the volume of new war plant construction, which was extremely heavy earlier in the year. However, backlogs are sufficiently large to maintain factory operations at a high level for a considerable period. Furthermore, increasing output of war material is steadily raising the demand for electrical production and maintenance items.

Adjustments in the war production program have already caused several contract cancellations and shutdowns in this area. So far the dislocations have not been widespread and have had small effect on production as a whole. Government contracts for a wide variety of equipment continue to be placed in substantial volume throughout the area.

Retail trade throughout the district continues at boom levels. The demand for electrical appliances is heavy and what merchandise is still available is going rapidly.

PACIFIC COAST

Wholesalers report rubber-covered wires and cables to be their lowest stocks. Their annual inventories will be slowed by lack of usual veteran crews, though low stocks of many standard items will partially compensate for this factor. Their usual seasonal business is practically non-existent.

Recent electrical orders for shipyards include $17,000 crane motors and controls; $17,500 transformers and $7,000 floodlights for a new yard; four 600-hp. motors and controls, costing $18,000, and 900,000 lb. welding rods and ten welding sets, totaling $80,000.

Industrial developments include a $5,000,000 shipyard enlargement at Tacoma; a 5,000-ton concentrating unit at Arlington, Wash., for separating copper and manganese, besides considerable new housing at Anaconda, Mont., and Miami, Ariz., for copper workers and for Guayule rubber plantations in California.

Recent orders cover $4,900 transformer oil for Vernita station of Bonneville system; two 250-kva. Moloney transformers for Los Angeles; $35,000 lead-covered varnished cambric cable for Bonneville lines; $5,000 grounding cable and fittings for Ampere, Wash., and recommended awards of $5,545 of I-T-E switchboards and $4,450 for Johns-Manville material by Tacoma for Nisqually system.

New government construction covers an operating base near Yuma with 21 barrack buildings as a nucleus; several groups of WAAC buildings in Arizona, and an air force installation, costing in excess of $5,000,000, at Mountain Home in Idaho.

Dividends Declared by Manufacturers

Electrical manufacturing companies have recently announced the following dividend payments:

Clark Controller, 50 cents brings 1942 total payments to $1.50, or 50 cents less than last year.

Babcock & Wilcox, 50 cents brings total for year to $1.50 against $2.50 last year.

Nash-Kelvinator, 12½ cents, payable December 28 to stockholders of record December 12. This brings payments for year to 50 cents, against 37½ cents in 1941.

Western Electric Co. board of directors at their meeting deferred consideration of a fourth quarter dividend to a special meeting to be called for the purpose just prior to the end of the year.

•

Western Electric Output Increases Sevenfold

With the production of war materials up more than seven times over 1941, and telephone manufacture for the Bell System greatly restricted for the duration, the Western Electric Co. looks ahead to "vastly greater" effort during the coming year, according to a statement addressed to employees by C. G. Stoll, president of the company.

Mr. Stoll's statement is included in a booklet commemorating Pearl Harbor —The Western Front—which records for the information of employees the performance of the company during the first year of the war. In addition to producing an extensive list of special combat equipment, Western Electric has equipped more than 2,000 military camps, depots, airfields and arsenals with standard telephone apparatus, cable and wire, while continuing to supply the essential needs of the Bell System.

Copper, a vital essential to electrical communications, has been reclaimed by Western Electric and its subsidiary, Nassau Smelting & Refining Co., on a vast scale during the past year. There have been processed thus far 23,000,000 pounds.

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"Stay on Job" Pledge

War workers in the Johns-Manville plant at Waukegan, Ill., have signed a pledge to "stay on the job" and "increase production." A bulky document with 1,969 signatures, addressed to the President of the United States, the pledge was delivered to Admiral Emory S. Land and Vice-Admiral Howard L. Vickery by a delegation from Waukegan representing the Labor-Management Committee of the Johns-Manville plant which is occupied almost exclusively with war production.

•

Lincoln Announces New Welding Award Program

The James F. Lincoln Arc Welding Foundation of Cleveland, Ohio, sponsor of the 1937-38 and 1940-42 nation wide $200,000 arc welding award programs, has announced its first award program in the field of undergraduate engineering study.

The foundation's new project is the $6,750 annual engineering undergraduate award and scholarship program, the object of which is "to encourage engineering students to study arc welded construction so that their imagination, ability and vision may be given opportunity to extend knowledge of this method and thus aid the war effort and the economic reconstruction in the peace which is to follow."

According to the program, $5,000 will be offered in student awards and $1,750 in scholarships for the departments of the institutions in which the award-winning students are registered. There are 77 student awards—a first award of $1,000, second of $500, third of $250, four awards of $150, eight of $100, twelve of $50 and fifty of $25. There are seven scholarships of $250 each.

•

DPC Executes Contracts

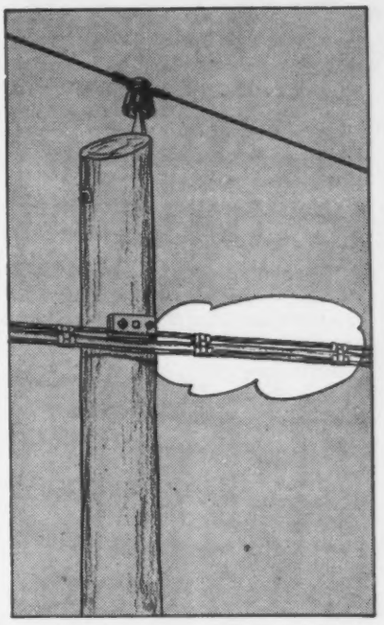
Execution of a contract with General Cable Corp., New York, N. Y., to provide machinery and equipment in a plant in New York State at a cost in excess of $800,000, has been announced by the Defense Plant Corporation. Contract has also been executed with the Sangamo Electric Co., Springfield, Ill., for machinery and equipment for a plant in Illinois. Both General Cable and Sangamo will operate the facilities, title remaining in DPC.

•

Nash-Kelvinator Net

Nash-Kelvinator Corp. reports a net profit for the fiscal year ended on September 30 of $3,828,755 after all charges, including depreciation, reserves and taxes. The profit is equal to 89 cents a share on 4,291,202 shares and compares with $4,617,052, or $1.07 a share, for the preceding fiscal year, when the company was engaged in the peacetime production of electric refrigerators and automobiles. The company reports its working capital increased $4,960,104 in the year.

Reduce Outages Avoid Cable Wear Reduce Maintenance



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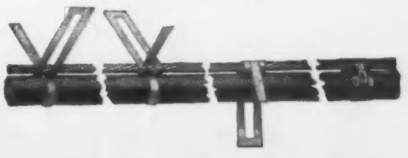

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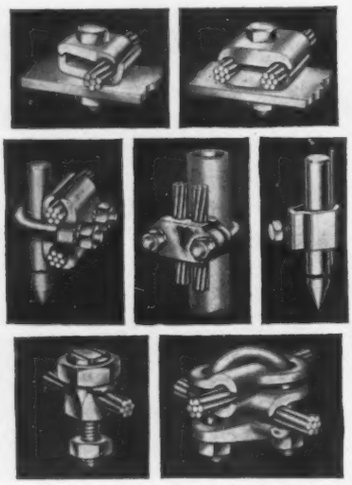
The pictures below can only give you an idea of the variety, because **Penn-Union makes ALL good types.**

Write us for any grounding connector, clamp or stud . . . for all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a *dependable* unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.



Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union connectors are the choice of leading utilities, industrials, contractors and electrical manufacturers.* Write for Catalog.

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LETTERS TO THE EDITOR

More Substitutes for "Substitute"

To the Editor of ELECTRICAL WORLD:

In a recent ELECTRICAL WORLD editorial (November 14 issue) you asked for an appropriate word to take the place of "synthetic" or "substitute" materials. An unfamiliar or newly coined word would not be likely to catch on. My suggestion is "Redesign Materials." This seems to me to imply adequate or even superior quality.

W. M. LEEDS,
Switchgear Design Engineer
Westinghouse Elec. & Mfg. Co.
Pittsburgh, Pa.

In our contact with the consumer, dealers and distributors, my personal experience has been that the use of the words "new" and "superseding" provides an answer for the very situation you mentioned. The connotation of those "positive" words, plus a definite expression of advantage, seems to impress the fact that some better things are now being evolved.

For example, along with the information that "new style range surface unit rings and pans, finished in a neat, practical dark blue porcelain enamel will be supplied in the future," we mention that one of the main advantages of the superseding parts is that they are so easily cleaned.

Possibly this is one of many responses to your editorial, and it may be that the views are all pretty much alike. Anyhow, I feel you may be interested in the approach of one consumer durable goods manufacturer.

D. C. MARBLE, Manager,
Product Service Division,
Edison General Electric Appliance Co., Inc., Chicago, Ill.

In considering a reply to your editorial of November 14, my first thought is that, to the modern mind, the prefix suggests inferiority; therefore, I will replace it with one that implies that the new product is better than its predecessor. Let me try a much overworked prefix of our day and coin the word "superstitute" or "superstute."

A better word—one more nearly fulfilling my desire to maintain as far as possible a high standard of speech—is "supersessor." However, good dictionaries already give us the noun "superseder."

In a very large sense these new products are creations, for while it is true that "only God can make a tree" or any of the elemental building blocks of the universe, yet He is allowing men to use these blocks in an increasing number of ways. With due reverence, let us say that these products are "created" materials.

JOHN F. STEVENS,
Masonville, N. J.

•

Three- to One-Phase Transformation

To the Editor of ELECTRICAL WORLD:

In the September 5 issue, page 62, you published an article "Three- to One-Phase Transformation," by A. L. Morris, from the *Electrical Review*, London, England.

Being interested, I attempted to follow the proof and I found that by no means could I reconcile my results with those illustrated. For example, I am not in agreement that at the point A, as indicated on Mr. Morris' sketch, it is possible to evolve a resultant current I_A from the two vectors I_X and I_{C1} with directions as shown. The resultant of those two vectors would approach the direction and magnitude of I_M.

I am inclosing a vector diagram of

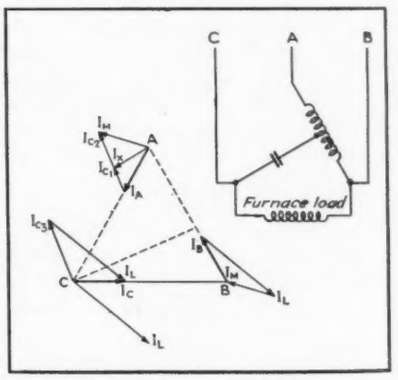

FIG. 1—Vector diagram in "Electrical World," September 5, 1942, issue of connections which balance single-phase load on three phases

my results using his circuit. Phase rotation is assumed to be A, B, C. Would you please give me an explanation of how Mr. Morris arrives at the direction and resultants of his vectors.

M. LUSCOMBE,
Electrical Department,
Aluminum Co. of Canada, Ltd.
Arvida, Quebec.

[NOTE—Vector diagrams by Mr. Morris and Mr. Luscombe are presented. Prof. A. A. Nims, electrical department, Newark College of Engineering, Newark, N. J., has prepared an explanation including two diagrams, one of which

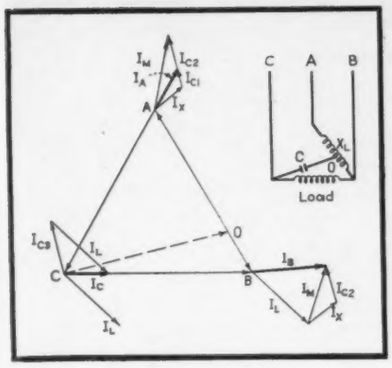

FIG. 2—Correspondent's solution

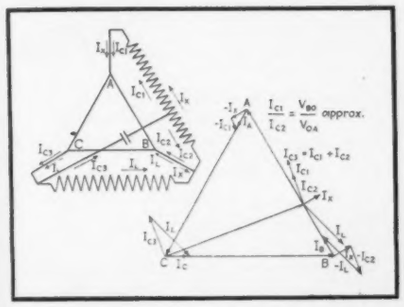

FIG. 3—Diagrams by Prof. Nims verify original result

has additional vectors serving to show intermediate steps for arriving at Mr. Morris' results. They confirm the diagram of the September 5, 1942, article in ELECTRICAL WORLD in this way:

Line currents flowing away from power source ABC, Fig. 3 (left), are:

$$I_A = -I_X - I_{C1}$$
$$I_B = I_X - I_{C2} - I_L$$
$$I_C = I_{C3} + I_L$$

Vectorial construction of these line currents are shown at vertices A, B and C of vector triangle (Fig. 3). In this same triangle I_{C3} leads voltage CO by 90 deg. approximately; I_L lags voltage CB by power factor angle of the load; I_X lags voltage BA by 90 deg. approximately.—EDITOR.]

•

Reports on War Effort

In a review of the company's war effort, A. W. Robertson, chairman of the Westinghouse Electric & Manufacturing Co., disclosed that Westinghouse has stepped up its monthly production from $34,000,000 worth of equipment last January to more than $52,000,000 in October, and to meet this schedule has added more than 1,500 new employees every month during the past year. In the last four years the company spent more than $165,000,000 for additional facilities. Of this amount $81,000,000 was provided by the government, and other millions will be refunded to the company over the years.

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Sales Opportunities

MISSOURI—Kansas City Power & Light Co., Kansas City, has approved plans for extensions in transmission lines in Kansas and Missouri with power substation and service facilities for power supply for industrial and federal developments. Work will be carried out at once.

PENNSYLVANIA — Vultee Aircraft, Inc., Vultee Field, Downey, Calif., manufacturer of bomber-type airplanes, has taken over large industrial plant and will remodel and equip for new Eastern plant, with installation of machinery and electrical equipment for extensive output. Several new buildings will be erected, with hangar unit. Work will begin soon. Cost estimated close to $11,000,000.

NEW JERSEY—War Department has authorized expansion in air force base, including shops, warehouses and other industrial structures. Electrical equipment will be installed, with additional power substation facilities. Cost estimated about $1,000,000. Project will be supervised by U. S. District Engineer Office, Philadelphia, Pa.

WASHINGTON—Boeing Airplane Co., Marginal Way, Seattle, plans expansion in aircraft plant, with installation of machinery and electrical equipment for large increased output. Work will be placed under way soon. Cost over $500,000, with financing by Defense Plant Corp.

ARKANSAS—Arkansas Power & Light Co., Little Rock, has contracted with U. S. District Engineer Office, same place, for relocation and changes in transmission lines, including underground services, at an airfield, to eliminate flying hazards. Cost about $50,000. Work is scheduled to be carried out at once.

LOUISIANA—Municipal Water, Light & Traction Department, Monroe, plans extensions in electric lines. Poles and other equipment will be purchased soon.

INDIANA—Commodity Credit Corp., Washington, D. C., and 208 South LaSalle Street, Chicago, Ill., federal agency, plans four new hemp-processing mills, each comprising several buildings, with power house and auxiliary structures, estimated to cost about $300,000, or total of $1,200,000 for project, including machinery and electrical equipment. Financing by Defense Plant Corp.

MASSACHUSETTS — Merrimack Mfg. Co., Lowell, has tentative plans for conversion of power plant at local textile mills from oil to coal fuel, including installation of stokers, coal and ash-handling machinery and auxiliary equipment.

NEW JERSEY—Walter Kidde & Co., Inc., 140 Cedar Street, New York, N. Y., manufacturer of fire extinguishers, etc., plans expansion of plant, with installation of machinery and electrical equipment for large increased capacity. This supplements a previous contract made by government with company and provides for an overall amount of $5,000,000 through Defense Plant Corp., including previous financing.

OHIO—Cincinnati Gas & Electric Co., Cincinnati, is considering early rebuilding of four-story equipment storage and distributing building, with laboratory division, recently destroyed by fire, with loss reported close to $250,000, including equipment.

CALIFORNIA — Bureau of Reclamation, Denver, Colo., receives bids until January 8 for two 15 x 19.05 ft. coaster gates for installation in intakes of two penstocks in Central Valley project. Equipment will be installed by government (Specifications 1053).

TEXAS—Navy Department plans new naval air base, including seaplane hangars, shops, warehouses and other industrial buildings. Electric equipment will be installed, with power substation facilities and distribution lines, including underground system, for airport, industrial and residential service. Entire project is reported to cost close to $10,000,000.

MINNESOTA—Northern States Power Co., Minneapolis, plans extensions in transmission lines for power supply for an industrial plant in that area, including substation and service facilities. Priority rating has been secured and work will be placed under way soon.

ILLINOIS—Bell & Howell Co., 1801 West Larchmont Avenue, Chicago, manufacturer of motion picture machines, parts, etc., plans expansion in plant, with installation of machinery and electrical equipment for large increased capacity. Cost over $500,000. Financing by Defense Plant Corp.

TEXAS—War Department has authorized expansion in air force base, including hangars, shops, warehouses and other industrial buildings. Electrical equipment will be installed, with additional power substation facilities and distribution lines. Cost over $2,000,000. Project will be supervised by U. S. District Engineer Office, Tulsa, Okla.

WASHINGTON — Seattle-Tacoma Shipbuilding Corp., Tacoma, plans extensions in a shipbuilding plant, including new shops, warehouses and other buildings, with installation of machinery and electrical equipment for large increased capacity. Work will be carried out at early date. Cost estimated over $2,500,000.

WISCONSIN—Commodity Credit Corp., Washington, D. C., and 208 South La Salle Street, Chicago, Ill., federal agency, plans series of eight hemp-processing plants, each comprising several one-story production buildings, power house and auxiliary structures, estimated to cost close to $300,000 each, with machinery and electrical equipment, making total of $2,400,000 for project. Financing by Defense Plant Corp.

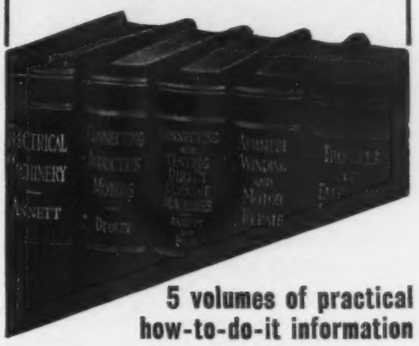
TENNESSEE—Marshall Stove Co., Lewisburg, manufacturer of stoves, ranges and parts, plans expansion in a plant, with installation of machinery and electrical equipment for large increased output. Work will be carried out at once. Cost over $400,000, with financing by Defense Plant Corp.

•

Acme Steel Bonus

Employees of the Acme Steel Co., whose service began on or before July 1, will receive as bonuses two weeks' salary or eighty hours' pay at basic hourly rates, Charles S. Traer, president, has announced. Those whose employment dates from July 2 will get one week's salary or forty hours' pay. Checks for employees in the armed services in all parts of the world will be made up on the same basis.

Every phase of electrical maintenance and repair work covered in this Library



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Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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Inter-American Plan Launched by A.S.A.

Trade and industrial development of the Americas will be furthered by a program of Inter-American co-operation on industrial and engineering standards which has recently been launched by the American Standards Association, P. G. Agnew, secretary of the association has stated.

Latin American countries have already shown a great deal of interest in North American standards and have asked the A.S.A. to supply them with further information.

Cyrus T. Brady, Jr., an engineer and sales executive, who has spent many years in South America, will serve as the field representative for A.S.A. He is being given a year's leave of absence by the U. S. Steel Export Co. for the purpose. Mr. Brady's work will be supported by an Inter-American Division in the New York office of the A.S.A., headed by Alberto Magno-Rodrigues, who has been for many years in charge of the activities of several American manufacturers of machinery in the Spanish and Portuguese markets.

In the new program the A.S.A. will exchange technical data in the development and use of standards with the other American republics, give them information on the standardization work being done in the United States, and provide them with Spanish and Portuguese translations of standards which would be especially valuable in developing their industry. A prime object of the program is to provide so thorough an interchange of technical data and information that, as a result, all of the countries of the Western Hemisphere will have standards as much alike as possible.

•

Westinghouse Lamp Opens New District Office

To achieve closer co-operation and greater efficiency in the handling of war effort business, the Westinghouse Lamp division recently replaced its branch office organization in Philadelphia with a complete district office which will serve parts of six states and the District of Columbia.

This new Middle Atlantic district is managed by Harry A. Croasdale, formerly assistant manager of the Middle Western district and at one time branch manager in Philadelphia.

B. H. Sullivan, general sales manager of the lamp division, explained that the new district will include seven counties in New Jersey, the entire states of Delaware, Maryland and Virginia, the District of Columbia, and parts of West Virginia and Pennsylvania. Mr. Sullivan announced that R. A. Corvey, Philadelphia branch manager, has been appointed assistant manager of the northeastern district with headquarters in New York City.

•

Release 40,000 Vacuum Cleaners

WPB has released for public sale 40,000 domestic vacuum cleaners frozen in the hands of manufacturers and private brand sellers since October 24. These cleaners, of tank and brush type, are in addition to those released for public sale November 21. Approximately 145,000 cleaners remain frozen for military and governmental use.

WPB also banned further manufacture of attachments for domestic cleaners, closing a loophole which has been open since production of cleaners was halted last April 30.

•

Hygienists Check Substitute Materials

Increasing use of substitute materials and new processes in war industries must be closely checked to prevent occupational disease hazards, E. C. Barnes, Westinghouse industrial hygiene engineer, stated before representatives of 250 heavy industries at the recent annual meeting of the Industrial Hygiene Foundation in the Mellon Institute.

Chemists, physicians and industrial hygienists, Mr. Barnes said, examine new operations at Westinghouse to eliminate health hazards before any change is made in the production line. Results of this ten-year program were apparent in the company's experience during the first six months of this year, when many substitute materials were introduced because of the war.

Among 85,000 industrial workers in 23 plants and 36 manufacturing and repair shops there were only five occupational diseases that caused lost time. Ninety-one million man-hours were worked in that period and less than a thousand were lost to the war effort because of occupational ills.

•

Gets Army-Navy "E"

Announcement has been made of the award of the Army-Navy "E" to employees of the Kansas ordnance plant, built and operated by the J-M Service Corp., a Johns-Manville subsidiary.

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Instrument expert by leading aircraft engine manufacturer in East. Engineering training and calibration experience required although not necessarily in aircraft engines. Must be able to devise new and more nearly accurate methods of temperature and pressure measurement and to improve existing methods. No applications sought from persons employed in war production.

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To the man who keeps his industry clear of the cry: "too little . . . and too late," cutting through a fog of uncertainty to anticipate tomorrow's demands today. Then, with load forecasts as a starting point, his real job of planning begins. A general of facilities yet unbuilt, he must maneuver his lines across a field of blue-print paper, supporting the present forces to the full as he brings up the reinforcements that will win the battle of production.

LET'S SALUTE THE . . .

SYSTEM PLANNING ENGINEER

WELL-LAID PLANS, prompt and expert execution, go together for victory anywhere. Backing up the men who plan America's power and light systems . . . a part of the field force which helps to carry them out . . . are GRAYBAR'S services of supply.

The responsibility for getting line materials and other equipment *where* they're needed *when* they're needed is being met faithfully by GRAYBAR.

Here, too, the answer is planning – planning in the location of GRAYBAR warehouses and in warehouse stock control – planning for the rallying of facilities from several points to meet critical needs – planning in the setup of field personnel so that utility customers are served by men familiar with their specifications and preferences – planning relationships with suppliers so that equipment that "goes together" best in service is obtainable from a single source.

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To Our Customers and Friends:

"Megger" Testers are, as you can well imagine, in unusually heavy demand during these strenuous days. Now, if ever, electrical equipment *must not fail*.

Although the demand has been for a quantity of instruments many times larger than our normal pre-war volume, we have so far been able to fill most high priority orders on schedule. Ours is the unique responsibility of supplying America's electrical men who must maintain electrical equipment on land, on the seas and in the air—with a testing device that is a vital necessity.

To this end we are now concentrating on the building of the more generally used types of "Megger" instruments in our Philadelphia factory We have complete manufacturing facilities, a loyal group of skilled men and women, and above all the *determination* to see that you get all the "Megger" Testers you need—at the earliest possible date.

JAMES G. BIDDLE CO.
January, 1943

P.S.—*We urge you to inform us as soon as possible of your requirements for "Megger" instruments, so that we can plan our production to meet your needs.*

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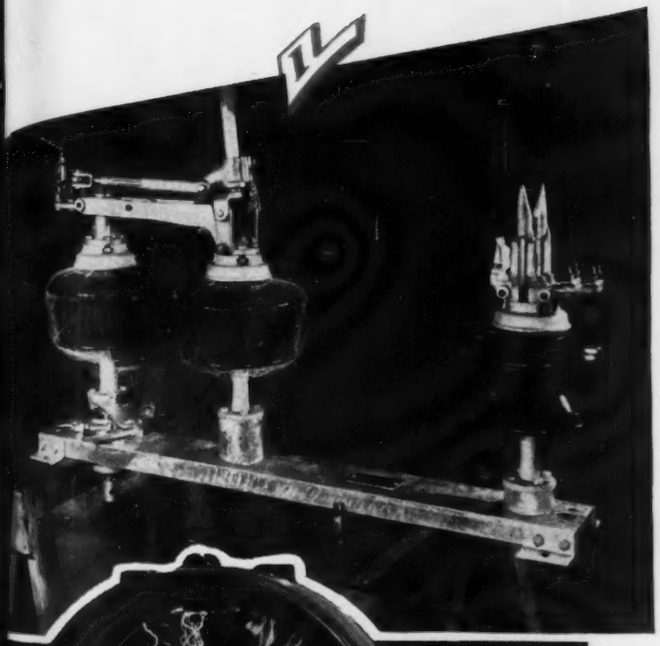


FLASHOVER TESTING FACILITIES

"Check the Facts" to prove the electrical characteristics of R&IE switching equipment.

1 Assembled outdoor 23 KV Hi-Pressure Contact switch during corona and flashover test.

2 Bus Section Special corona and flashover test - 73 KV for two minutes on bus support assembly. Each insulator is given a withholding test of 45 KV for one minute.

3 Routine flashover test on Indoor insulator assemblies. Note that each unit is flashed individually.

We check the facts to assure you that the design of R & I E Equipment is correct according to its insulation rating, so that its performance will meet your increasingly rigid operating requirements.

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

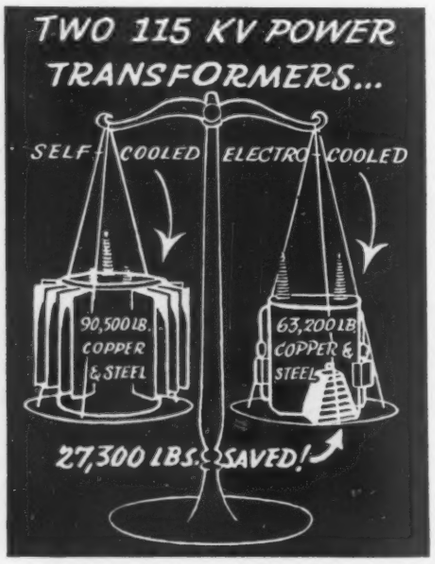
IN TORONTO, CANADA - EASTERN POWER DEVICES, Ltd.

ADD SENSATIONAL NEW
YOUR ALLIS-CHALMERS
..AND ADD UP TO 60%

★ New ELECTRO-COOLERS can step up the capacity of most transformers now in service by 20 to 60%. Installation is quick, simple!

★ Allis-Chalmers' new ELECTRO-COOLER is self-contained and self-supporting...employs no stuffing boxes...is self-lubricating. Here's the coming thing in forced-oil cooling—a sound long-term investment!

★ New transformers built with Allis-Chalmers ELECTRO-COOLERS use 25% less copper and steel...cost correspondingly less!



Savings like these can be made on every contemplated power transformer!

HERE'S important news for hard-pressed systems: if your transformers are peak-loaded — and you still face increasing loads — there's a new unit designed to *jump* transformer capacity . . . the new Allis-Chalmers ELECTRO-COOLER!

On most transformers, the new ELECTRO-COOLER can step up capacity 20 to 60%!

And if you have Allis-Chalmers transformers equipped with radiator valves in service, new ELECTRO-COOLERS can be added without even removing the oil!

New foundations are not required . . . there's no need to shift transformers. ELECTRO-COOLERS are self-contained and self-supporting!

Don't confuse this new ELECTRO-COOLER with adaptations of air-conditioning devices. From top to bottom, it's engineered specifically for forced-oil cooling. Here's a wartime investment with a great peacetime future!

Applied to new transformers, the new ELECTRO-COOLER reduces copper and steel needed by about 25%. Added to existing transformers, it saves up to four times its own weight in scrapped radiator steel!

Today, get the full story on how the new ELECTRO-COOLER can solve wartime problems of *your* system. Write for Bulletin B6242 — and contact your nearby district office. ALLIS-CHALMERS MFG. CO., MILWAUKEE.

A 1565

ALLIS-CHALMERS

ELECTRO-COOLERS TO POWER TRANSFORMERS TO THEIR CAPACITY!

New Electro-Cooler
OIL FLOW
CORE & COILS
OIL FLOW
SYSTEM SPECIFICALLY DESIGNED FOR THE FORCED OIL COOLING OF POWER TRANSFORMERS

HIGHLIGHTS

EASILY INSTALLED or removed—*without* shifting the transformer. If the transformer has radiator valves, there is no need even to drain the oil!

FACTORY SEALED! No pipe connections or joints to be made in the field. ELECTRO-COOLER is factory-assembled as a unit.

NO GLANDS or stuffing boxes! Oil drips and air bubbles are eliminated—nor is there any need to replace or fix packing.

ONLY ONE SHAFT! Motor and pump are designed as a complete unit — on one shaft and in one frame. Result: greater mechanical strength, fewer parts, fewer mechanical fits.

SIMPLICITY! The three-phase squirrel cage motor has no starting brushes, commutator, or other such wearing parts.

SELF-LUBRICATED motor and pump are totally enclosed and immersed in oil.

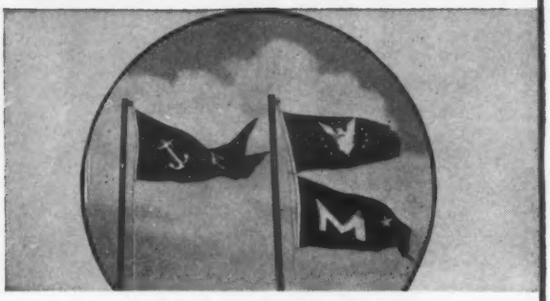
HIGH-PRESSURE TESTED! Possibility of oil leaks or seepage is eliminated by testing the ELECTRO-COOLER at 50 pounds pressure. Maximum working pressure is only a few pounds.

SELF-CONTAINED and self supporting! The new ELECTRO-COOLER required no foundations, no piping, no connections.

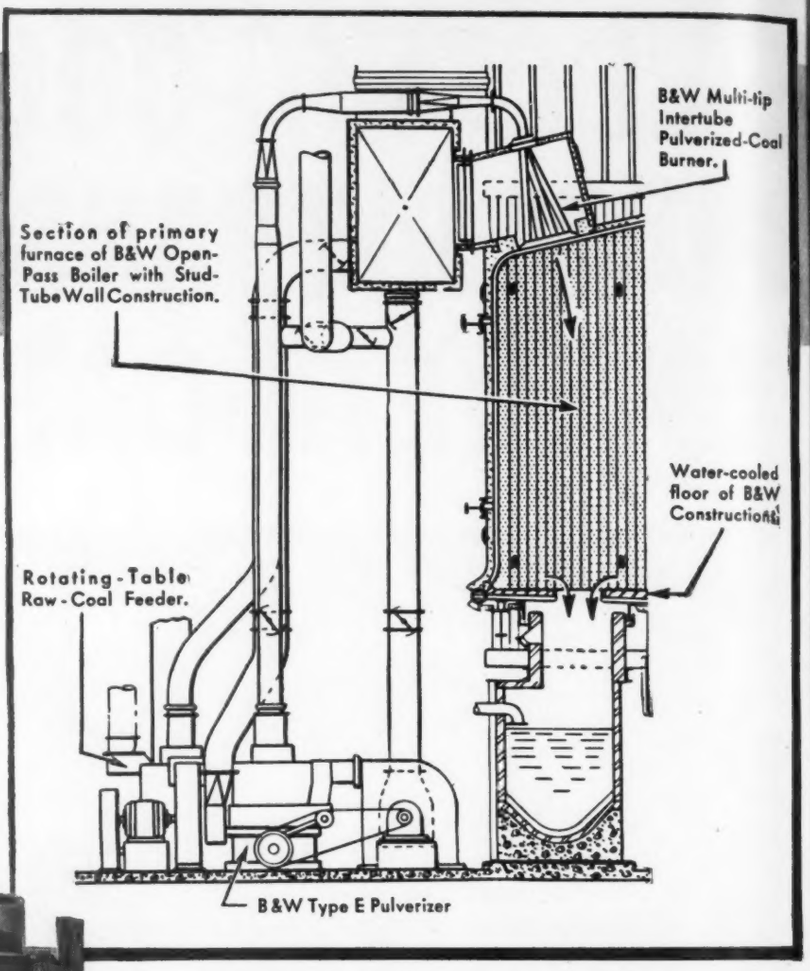
TRANSFORMERS

A-C ALLIS-CHALMERS MILWAUKEE

WE WORK FOR VICTORY WE PLAN FOR PEACE

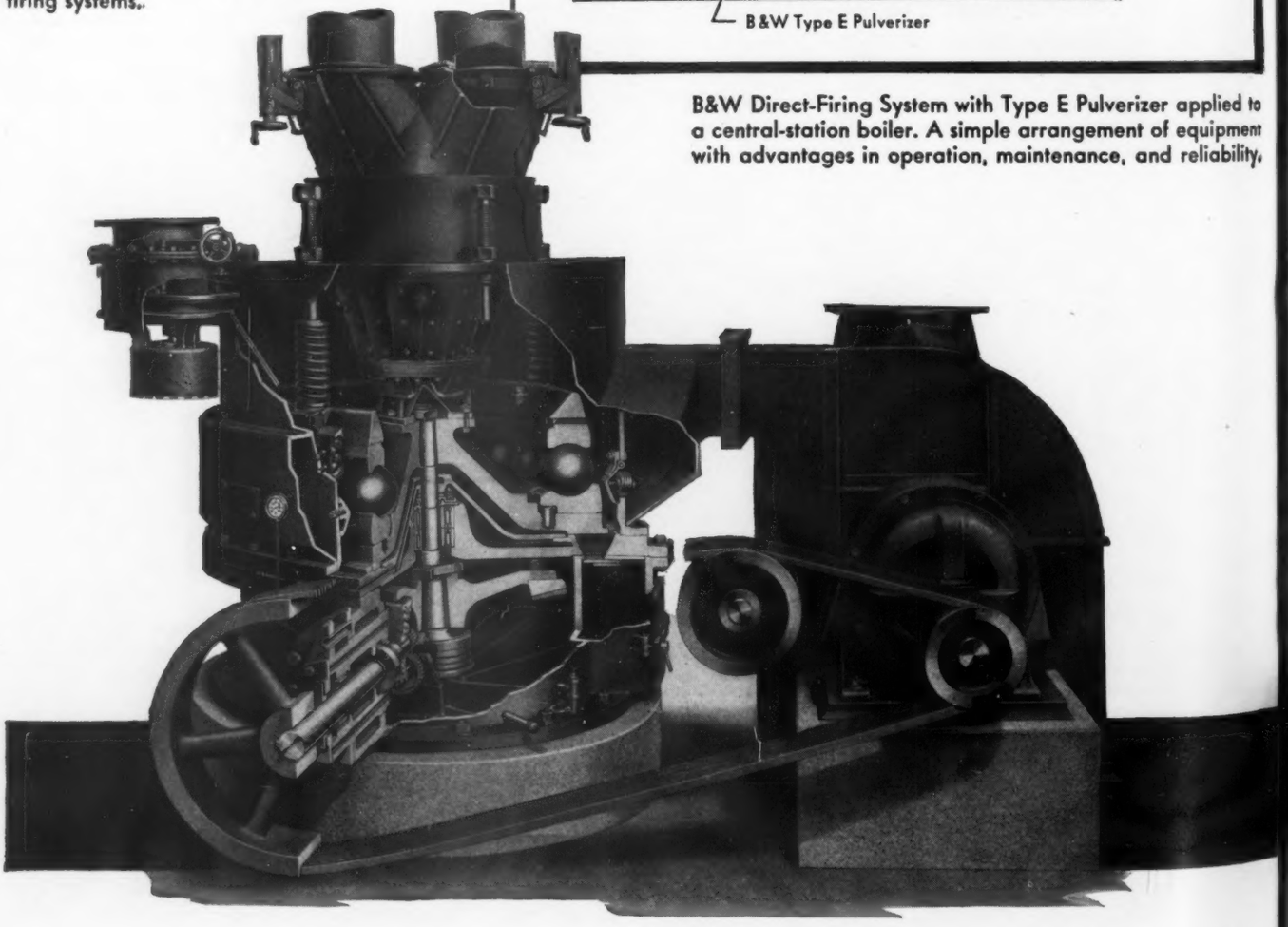


The Maritime Victory flag and "M" burgee now float proudly alongside the Navy "E" at the Barberton Works. Each is an award for "outstanding achievement" and is "an honor not lightly bestowed".


B&W Multi-tip Intertube Pulverized-Coal Burner.
Section of primary furnace of B&W Open-Pass Boiler with Stud-Tube Wall Construction.
Water-cooled floor of B&W Construction
Rotating-Table Raw-Coal Feeder.
B&W Type E Pulverizer

B&W Type E Pulverizer, with ball-bearing principle of grinding, for economy and reliability in direct-firing systems.

B&W Direct-Firing System with Type E Pulverizer applied to a central-station boiler. A simple arrangement of equipment with advantages in operation, maintenance, and reliability.



B&W

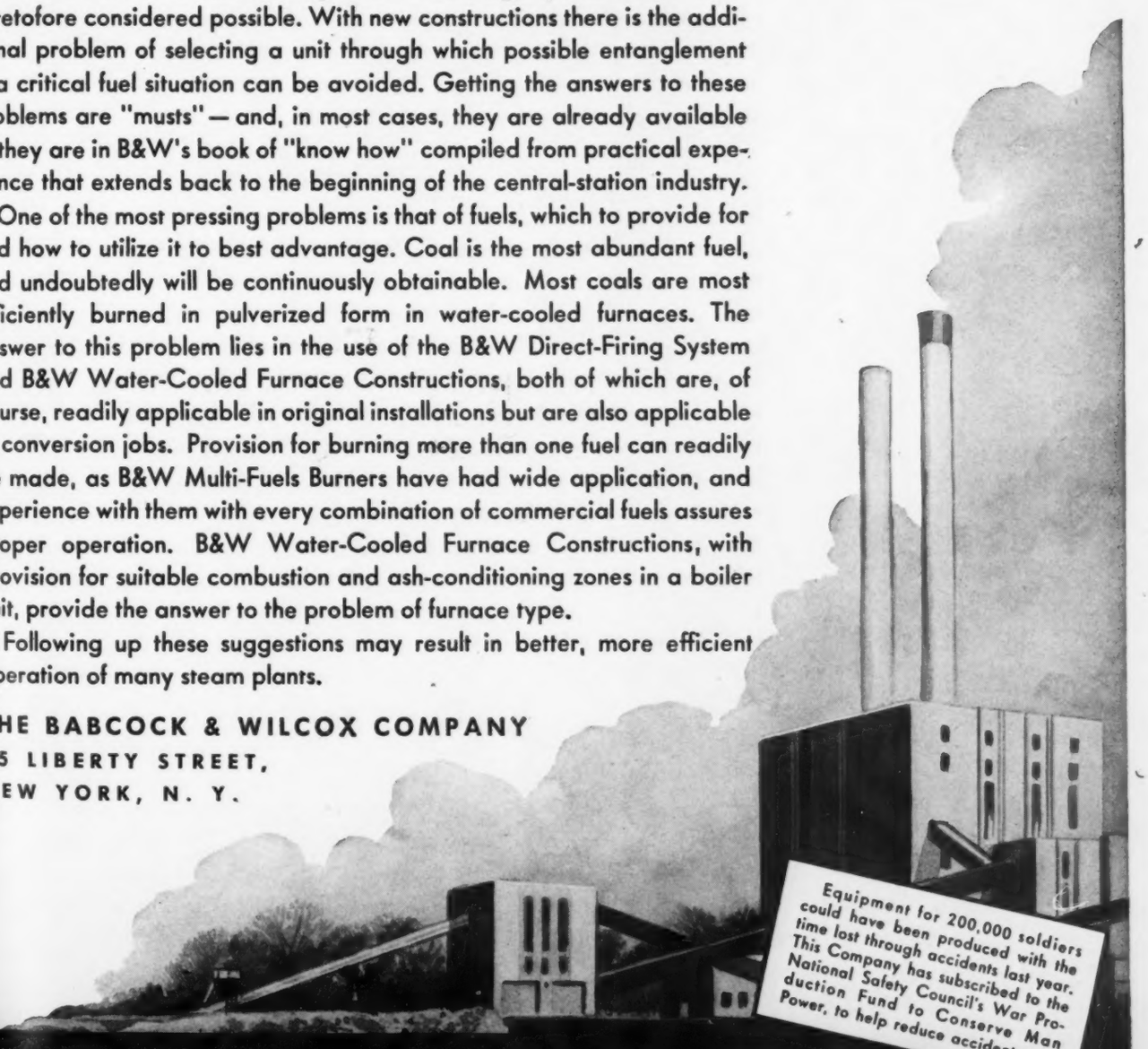
Skill and Experience can Help You with your Steam-generating Problems

Wartime operation of steam plants has brought many problems, the most general being those of how to get the most steam from existing equipment, and how to continue doing so for even longer periods than were heretofore considered possible. With new constructions there is the additional problem of selecting a unit through which possible entanglement in a critical fuel situation can be avoided. Getting the answers to these problems are "musts" — and, in most cases, they are already available — they are in B&W's book of "know how" compiled from practical experience that extends back to the beginning of the central-station industry.

One of the most pressing problems is that of fuels, which to provide for and how to utilize it to best advantage. Coal is the most abundant fuel, and undoubtedly will be continuously obtainable. Most coals are most efficiently burned in pulverized form in water-cooled furnaces. The answer to this problem lies in the use of the B&W Direct-Firing System and B&W Water-Cooled Furnace Constructions, both of which are, of course, readily applicable in original installations but are also applicable to conversion jobs. Provision for burning more than one fuel can readily be made, as B&W Multi-Fuels Burners have had wide application, and experience with them with every combination of commercial fuels assures proper operation. B&W Water-Cooled Furnace Constructions, with provision for suitable combustion and ash-conditioning zones in a boiler unit, provide the answer to the problem of furnace type.

Following up these suggestions may result in better, more efficient operation of many steam plants.

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET,
NEW YORK, N. Y.


Equipment for 200,000 soldiers could have been produced with the time lost through accidents last year. This Company has subscribed to the National Safety Council's War Production Fund to Conserve Man Power, to help reduce accidents.

BABCOCK & WILCOX

G237-T

★ ★ ★

A WORKABLE FOR NON-CRITICAL INSULATION

For two principal reasons, conductor cable is still available for many lines today. Some lines are in service and voltage is planned to be increased. Others are to be shifted to a new, more advantageous location; again using the same conductor. In both cases, insulators are one of the largest factors coming under the head of new purchases.

Here is a non-critical insulation arrangement applicable to all circuits up to 69 kv. and in special cases even somewhat higher. It is strictly a wartime measure; lacking the permanence that normally characterizes modern high-voltage construction practices, but making possible the construction of certain lines that might otherwise be impossible. It is presented as an expedient — although a thoroughly practical one!

Some power companies have found that they cannot use the insulator they want, because of their inability to obtain suitable steel pins. These are the best, of course, but they are practically off the market, and otherwise involve almost endless delays in shipment. If, however, they can be purchased, we certainly do not intend to depreciate their definitely superior qualities. But if they can't be bought, then what?

This question has been before O-B research men in the Barberton High-voltage Laboratory. Tests are now running to completion on various substitute insulation methods. Present data on these tests enables us to draw some general conclusions, and we want to put these into your hands promptly for consideration, with final results to come a little later.

In place of the forged steel pin in a pintype insulator, a serviceable line can be built with a standard insulator mounted on a wood pin; this pin having previously been dipped in O-B Conduction Paint. The paint constitutes a reasonable substitute for former metal parts. The painted pin is equivalent to a steel pin in essential electrical characteristics and resistance to pin burning, and when used with O-B Silentype insulators, the combination is free of radio interference. Naturally, there exists here the disadvantage of lower mechanical strength but this problem is usually not extremely critical.

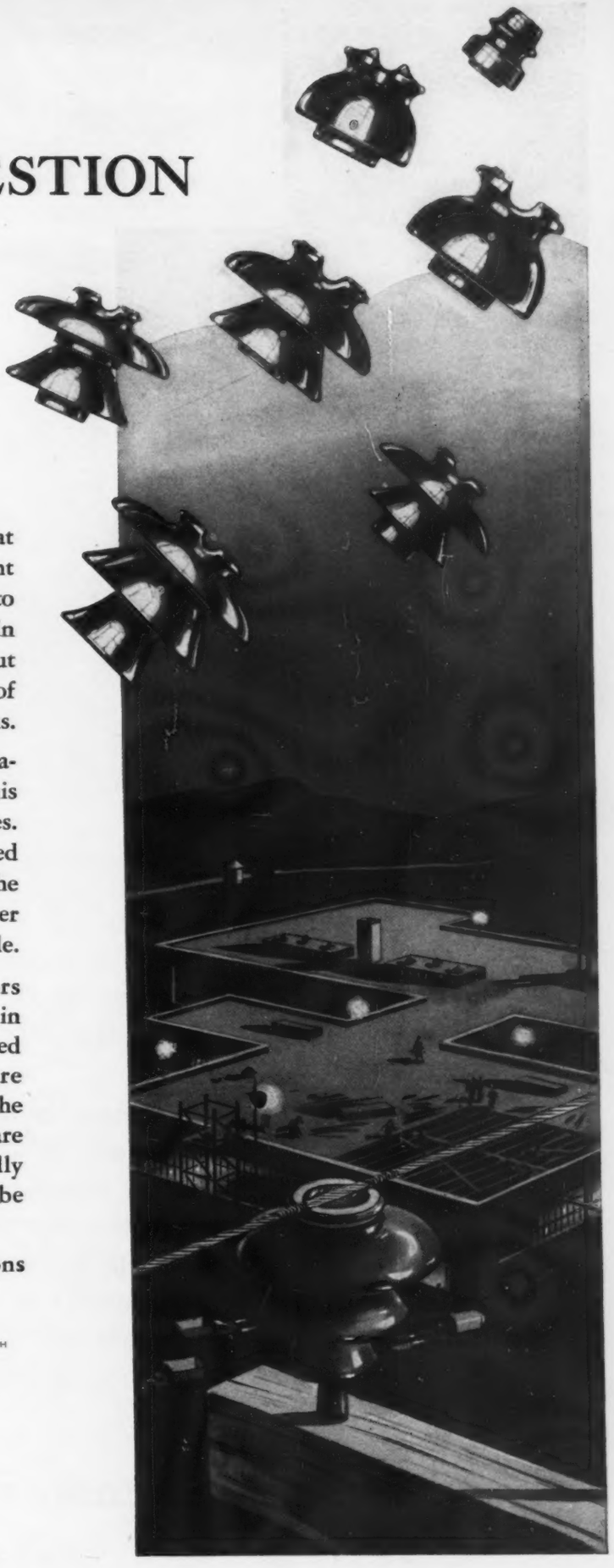
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario

WARTIME SUGGESTION

UP TO 69 KV.



The obvious advantage of this arrangement is that it involves materials that can largely be "bought over the counter." Furthermore, there appears to be no shortage of such materials, at present or in prospect. Conduction paint is rated as critical, but it is used in very small quantities at a saving of large volumes of much more highly critical items.

For re-insulation at higher voltages or for re-location of lines, often requiring new insulators, this suggestion may be of value to power companies. We frankly admit its temporary nature, measured in terms of five or ten years, but it will meet the emergency existing today so economically that later permanent construction will be perfectly feasible.

Some of the standard O-B pintype insulators adapted to this plan are shown here. Other units in the O-B line, including Silentypes, are described in our No. 24 Catalog. Since this procedure throws somewhat more dependence upon the insulator itself, you must be sure of what you are installing. Furthermore, the whole idea is naturally based upon these insulators, and data will be obtained from them.

We most sincerely hope that these suggestions will be helpful to you.

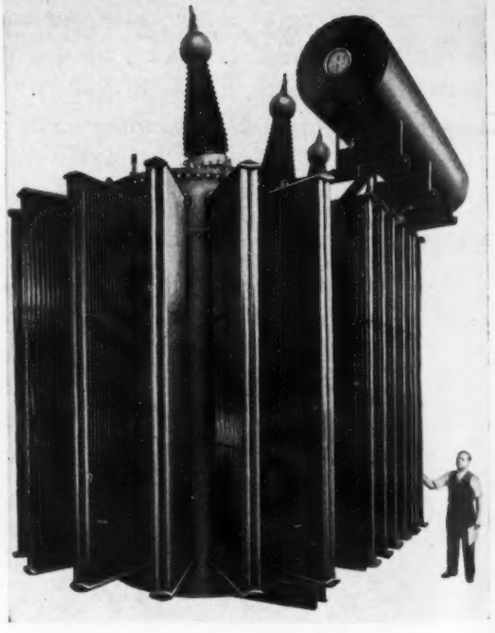
2354-H

Moloney Transformers Help Build Tanks

ALONG with the many other war jobs that they are doing for Uncle Sam, Moloney Transformers are helping build tanks that have proved their ability to outslug heavier Axis opponents in North Africa and Russia.

"All Out" Production requires an uninterrupted supply of Electric Power. Transformers through which this power is supplied must be capable of providing continuous service under all operating conditions. Moloney Transformers have proved their ability to withstand the most severe types of service encountered in the manufacture of all war materiel.

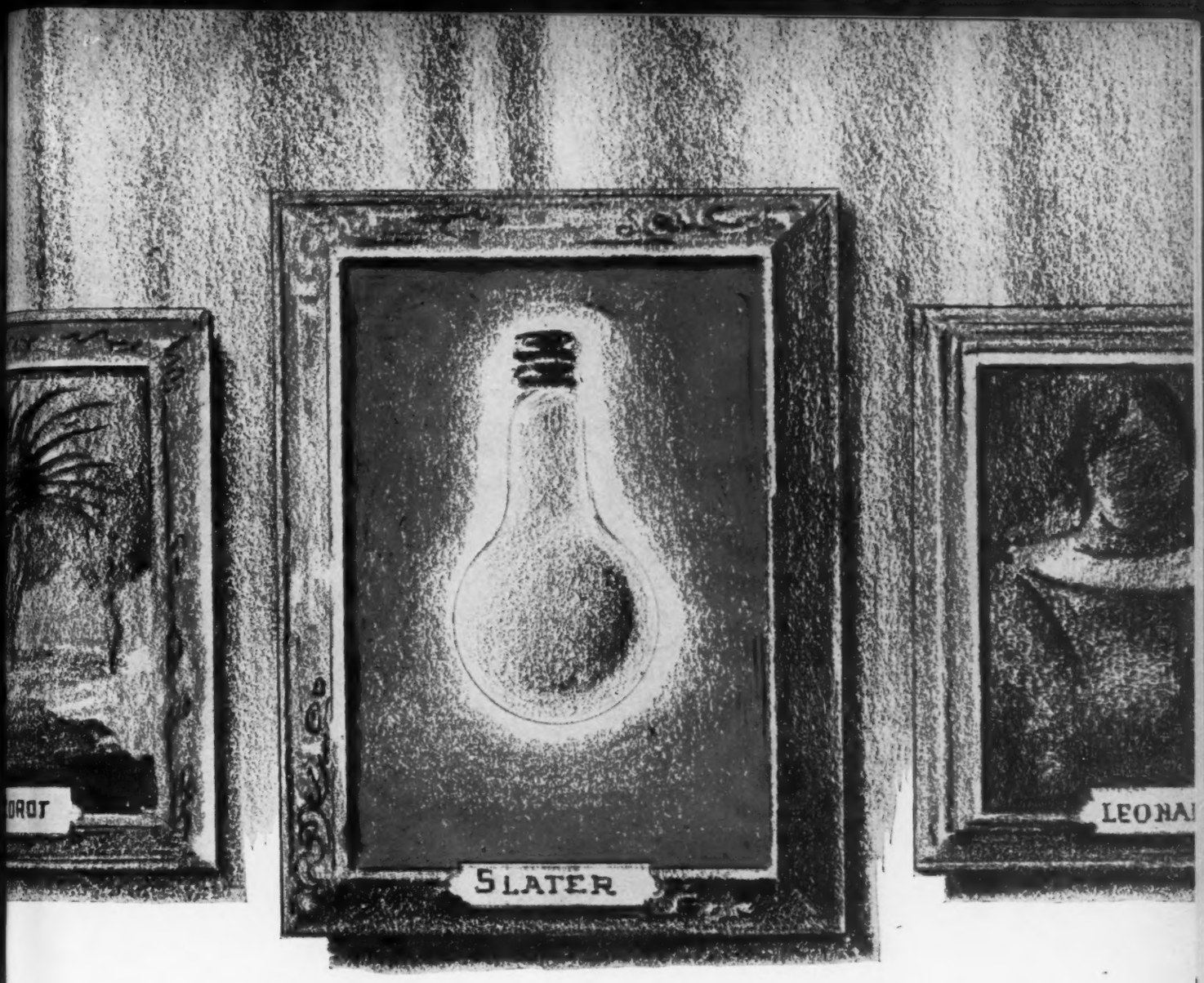
For dependable, trouble-free service, specify Moloney Transformers.



23,500 Kva, 115,000 volt three-phase transformer with conservator.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

TRANSFORMERS EXCLUSIVELY SINCE 1896



The Technique of **STREET LIGHTING** *is also an Art –*

BEGINNING WITH THE LAMP itself a guild of masters blaze the trails to carry American life around the clock. Through mazes of urban paths to rural reaches, many specialists lend touches to produce the ideal in illumination suited to special needs.

In the Slater Laboratories, specialists design for efficient illumination—Production specialists assemble the product for economical life—Utility specialists add the touches for local effectiveness and safety—Maintenance specialists carry on with economical group replacement.

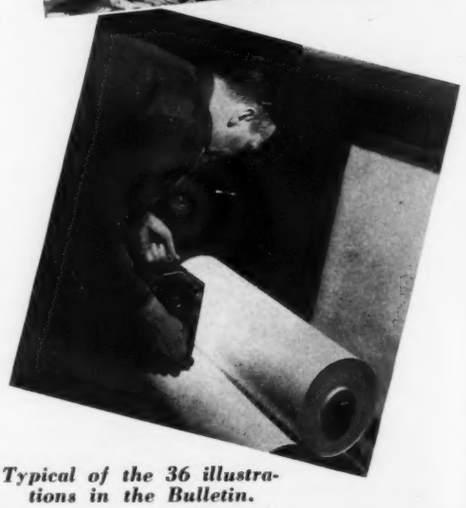
The Slater organization prizes its cooperation with specialists in cities and municipalities across the country whose work it is to provide street lighting lamps and traffic lights.

By specializing in lamps for these specialized services an Art is provided which continually grows through intensive, cooperative development.

Immediate shipments available from stock.

SLATER ELECTRIC & MFG. CO.
BROOKLYN, N.Y.

Makers of Special Precision ELECTRONIC TUBES *for the U.S. Army and Navy*



YOUR COPY is now ready

Like the stroboscope itself, this booklet may "flash" for you a new stroboscopic technique or use from the many industries where the stroboscope is indispensable in the design, production, test and application of moving mechanisms.

EYES FOR INDUSTRY contains a clear explanation of how the General Radio Strobotac and Strobolux work; what they will do; slow motion observation; speed measurements and stroboscopic photography. Included are numerous examples of how industry has use.. them to improve design, speed production and to solve unusual research problems.

This information should be helpful to engineers in both electrical manufacturing and electrical utilities, especially those who use stroboscopes to attain or maintain war production standards. Write for Bulletin No. 813.

Because all our facilities are devoted to war projects, the Strobotac and Strobolux are at present available only for war work.

Typical of the 36 illustrations in the Bulletin.

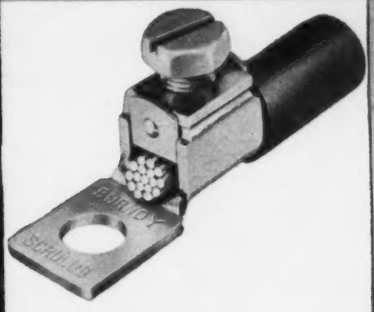
GR GENERAL RADIO COMPANY · Cambridge, Massachusetts

Quick Guide TO FASTER PRODUCTION

WAR TIME WITH BURNDY CONNECTORS

XPA

crulug is ideal for fuse
, panel boards, terminal
, etc. Install with screw
wrench or pliers. Range
#14 Sol. to 4/0 Str.



QA-B

se wherever cables are
inated, the Qiklug fea-
rapid installation, high
gth. Each unit takes a
. For #14 Sol. through
Mcm.

Q2A-B

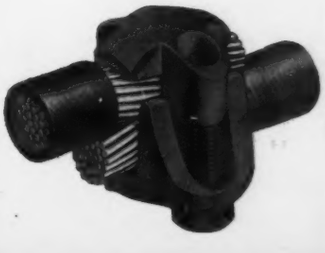
riation of Type QA-B
e, for connecting two
s to a single terminal
Fast, secure, compact.
able in sizes from #14
o 2000 Mcm.

E KS

Burndy Servit, popular
ctor for joining wires or
s in parallel. Quickly
led with a wrench. 13
take from #10 Sol. to
Mcm.

E KVS

y duty connector for join-
ables in parallel. Multiple
give extra pressure.
alled with standard
ch. Four sizes from #4/0
000 Mcm.



TYPE QPX

Each unit of the Versitap can be used as a T-connector, parallel tap, cross or end connector. Available in sizes from #6 Str. through 1000 Mcm.

TYPE BA-H

Only two sizes of the Toolug take from #22 Str. through #8 Str. Rapidly installed by hand pliers, or by pneumatic or hydraulic presses.

(SEE HYPRESS BELOW)

TYPE YA

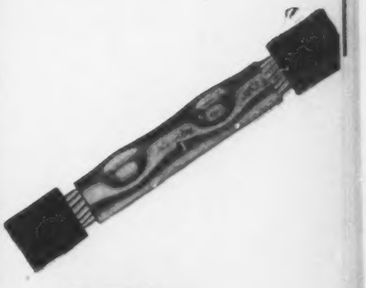
Hylug crimped by hand pliers or pneumatic or hydraulic presses. A record-breaker for fast installation, strength, compactness. From #22 Str. to 2000 Mcm.

(SEE HYPRESS BELOW)

TYPE YS

Hylink installed by hand pliers or pneumatic or hydraulic presses, for joining cables of equal size on end. For all cable sizes from #22 Str. through 2000 Mcm.

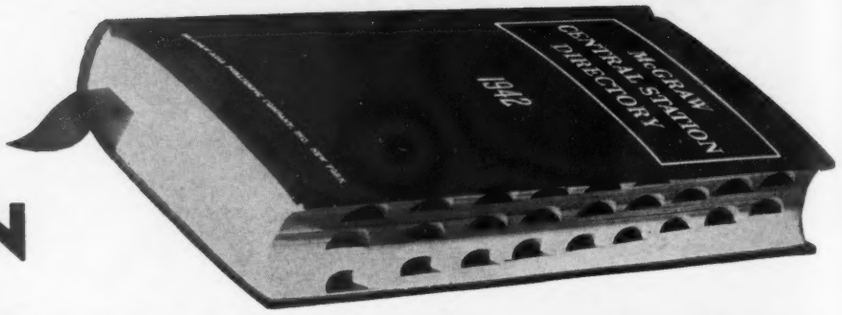
(SEE HYPRESS BELOW)



HYPRESS

Type Y—B foot operated, hydraulic Hypress. For rapid crimping of Hylugs and Hylinks on cables. Pneumatic, portable and bench-assembly types also available.

THE 1942 EDITION



McGRAW CENTRAL STATION DIRECTORY

Here's the book that gives you the latest changes in the utility field . . . it saves you time, travel and needless expense . . . assures correct contacts for priority orders

CONTENTS OF THIS HANDY, STURDILY-BOUND VOLUME

Names and addresses of independently owned and municipally operated electric light and power companies in the United States, Canada and U. S. Possessions; also, government controlled projects, State Commissions, and National and State Associations.

Names and addresses of affiliated, holding, controlling or managing and service companies with complete lists of properties controlled or managed by each, and including names and addresses of principal officials.

Names and addresses of officials and chief operating men for all operating companies.

For each operating company, the following information is presented:

Company total and Plant individual generating Capacity in kva. or kw.

Kind of Prime Mover and Capacity in hp.

Amount of power purchased in kw. hrs.

Type of current distributed, No. of wires, phase, voltage and cycle.

Circuit Miles Underground—duct distribution.

No. of meters served.

Location of power plants.

Location of districts or divisions.

Complete list of towns (of 500 Population or over) served.

Complete alphabetical index of companies listed.

NEARLY 900 PAGES

- *Sturdily bound in flexible blue Fabrikoid.*
- *Fully thumb-indexed.*
- *Size, 4½ inches by 8½ inches—easy to carry, handle and use.*
- *Published annually.*
- *Price, $25.00 per Copy—10% discount on 5 or more copies.*

If the electric utility market is part of your picture, you can't afford to be without this new 1942 McGraw Central Station Directory. For there have been changes in the utility field during the past year—plenty!

Personnel has been changed . . . key men have been shifted . . . new power plants have been built to meet unprecedented load demands. The McGraw Central Station Directory supplies all the essential facts concerning these changes plus other complete, up-to-date information, in a form easy to use.

With manufacturers' sales forces decreased and new buyers and buying influences in the picture, this directory is an indispensable aid in providing vital information for new sales approaches.

How Hundreds Are Now Using This Directory

Manufacturers of Electrical Generating, Transmission and Distribution Equipment:

To secure names and addresses of utility officials, determination of important utility operating data and scope of utilities' operation.

Manufacturers of General Equipment and Supplies:

To secure names and addresses of utility plant officials, engineers, and purchasing agents, and determination of probable purchasing power for utility requirements.

Electrical Utilities:

To know organizational structure of other utilities, to keep posted on movements of utility officials and to size up discernible trends in expansion of operations.

Financial Houses, Consulting and Contracting Engineers, Commissions and Others:

To keep posted on changes in utility personnel, to know the organizational structure of every company and to secure a complete picture of each company's scope and operating data.

SEND TODAY FOR YOUR COPY OF THIS VALUABLE GUIDE TO UTILITY RELATIONS

McGRAW-HILL PUBLISHING COMPANY

CATALOG & DIRECTORY DIVISION • 330 WEST 42nd ST., NEW YORK, N. Y.

FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save With

War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

ELECTRICAL WORLD

TO PROTECT YOUR CABLES
AGAINST MOISTURE *Use G & W Potheads*

Joints stay tight under a *wide temperature range*

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7780 DANTE AVENUE
CHICAGO, ILLINOIS, U. S. A.
In Canada—Powerlite Devices, Ltd., Toronto

Write for
BUL. 392

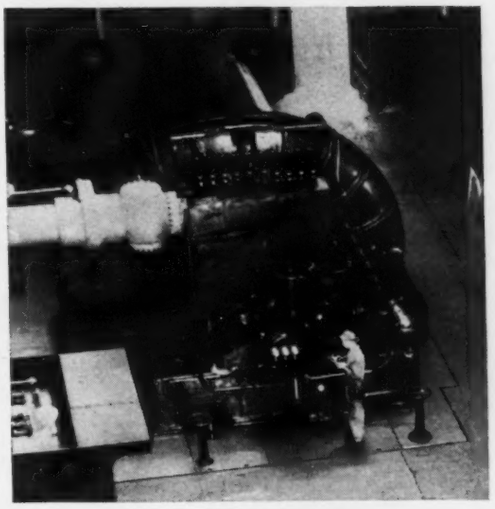
G&W ELECTRIC CABLE DEVICES

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

Gulfcrest Oil
is super-refined—

It's Alchlor Processed!

The unequaled refining power of the Alchlor Process insures better turbine lubrication.



This 25,000 kw General Electric turbine is lubricated with Gulfcrest Oil A

GULFCREST OIL is not only refined from the best selected crude oils produced in the United States — it is super-refined by the Gulf Alchlor Process, the most effective method known for removing the undesirable constituents present in all crudes.

In addition to purifying the oil thoroughly, the Alchlor Process synthesizes and rearranges the molecular structure of certain of its hydrocarbons, resulting in a finished product of highest stability and endurance. Gulfcrest Oil is the world's finest oil for the lubrication of steam turbines!

Write today for the story of Gulfcrest Oil and what it can do for you—no obligation, of course.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company EW
3800 Gulf Building, Pittsburgh, Pa.

Please send me my copy — no charge — of the brochure "Gulfcrest Oil."

Name.....

Company.....

Title.....

Address.....

(Another in a series of advertisements demonstrating the thoroughness of Anaconda research in electrical wires and cables.)

First came a vastly improved finishing compound, more stable, more uniform than the commonly used stearin pitch.

A research that bore twins ...8 YEARS APART

NOW

8 years later came a twin, just as important as the compound improvement itself...the saving of large quantities of war vital fats.

Of course, in 1934 Anaconda engineers did not know that we would be at war or that there would be such a shortage of fats and greases which are so vital to the war effort. Be that as it may, in that year they developed this new finishing compound to replace stearin pitch and brought about a very gratifying result... a highly stable, uniform finishing compound just about fool-proof in use.

This constant search for better products ... many times with such double-barrel results as this... characterizes the activities of Anaconda engineers. They have produced many wire and cable improvements, many of them, now cloaked in war censorship. But with peace, Anaconda, through these improvements, will serve industry as effectively as they are serving the war program today. 42274

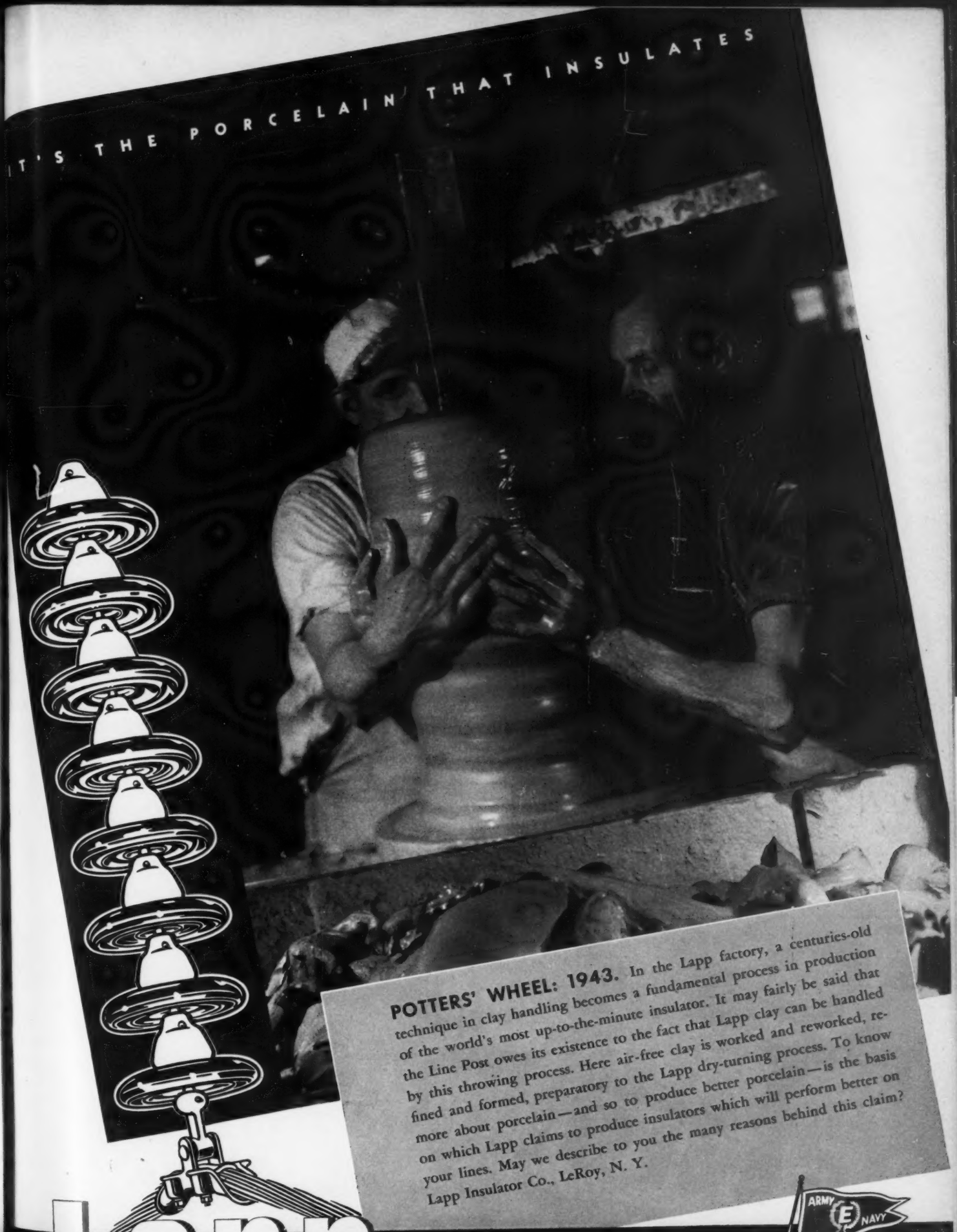
Two marks of achievement—The cherished Navy "E" (awarded to two of our plants) for achievement in production . . . the Anaconda trade-mark for achievement in quality.

ELECTRICAL WIRES AND CABLES OF COPPER ARE THE LIFE LINES OF OUR NATION

ANACONDA WIRE & CABLE COMPANY

Subsidiary of Anaconda Copper Mining Company

GENERAL OFFICES: 25 BROADWAY, NEW YORK CITY • CHICAGO OFFICES: 20 N. WACKER DRIVE • SALES OFFICES IN PRINCIPAL CITIES



POTTERS' WHEEL: 1943. In the Lapp factory, a centuries-old technique in clay handling becomes a fundamental process in production of the world's most up-to-the-minute insulator. It may fairly be said that the Line Post owes its existence to the fact that Lapp clay can be handled by this throwing process. Here air-free clay is worked and reworked, refined and formed, preparatory to the Lapp dry-turning process. To know more about porcelain—and so to produce better porcelain—is the basis on which Lapp claims to produce insulators which will perform better on your lines. May we describe to you the many reasons behind this claim?

Lapp Insulator Co., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

It's all in the plugs

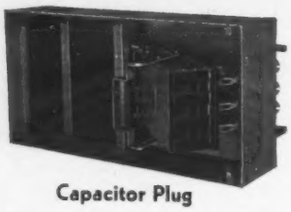
FLEX-A-PLUGS

COMPLETE the TRUMBULL

ENCLOSED BUSBAR DISTRIBUTION SYSTEM

FULL benefits of this system, are dependent upon the wide variety and unique engineering features of FLEX-A-PLUGS that permit immediate connection or disconnection of motor driven machines at any point (12" centers) on the line.

CONSERVE... ELECTRICITY BY CORRECTING POWER FACTOR AT POINT OF LOAD



Capacitor Plug

Switch disconnect unit raised to show rear stab connections to busbars in Flex-A-Plugs.

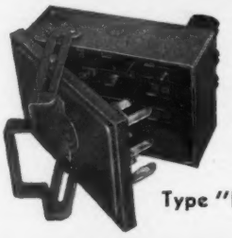
Here, for the first time, is a practical and economical method of conserving electric power by correcting unsatisfactory power factor conditions right at the point of load. **Trumbull Capacitor Plugs,** containing a **G-E Pyranol Capacitor** and switching or circuit breaker disconnects, can be plugged into a Flex-A-Power run at any point along the line.

A maximum saving in power can thus be achieved by installing properly rated correction units wherever poor power factor loads are located. If machines are moved or load conditions vary, the Trumbull Capacitor Plugs may be quickly relocated to meet the new load requirements.

For complete information about Flex-A-Plugs and the entire Trumbull Enclosed Busbar Distribution Systems, write for Trumbull Bulletin 408.

Capacitor Plug Circuit Breaker Disconnect.

CONNECT... MACHINES IN A MATTER OF MINUTES



Type "F. L."

Flex-A-Plugs, with "stab" connections to buses, simply plug into Flex-A-Power runs at intervals of 12" or more.

PROTECT... WITH FUSED SWITCHES RATED IN HORSEPOWER OR CIRCUIT BREAKERS

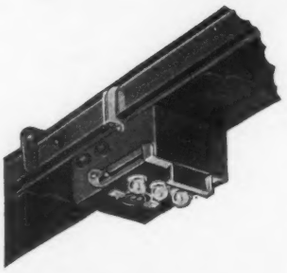
Type "F. E."

Type "F. E." Flex-A-Plugs have Trumbull Type "AT" Automatic Circuit Breaker Mechanism providing automatic over current and short circuit protection.

Type "F. D." plugs contain Type "RBA" heavy duty motor circuit safety switch mechanism.

Type "F. L." plugs with cam operated cover have double break switch mechanism with fuses accessible only when fully disconnected.

INDICATE... PHASE FAILURE IMMEDIATELY



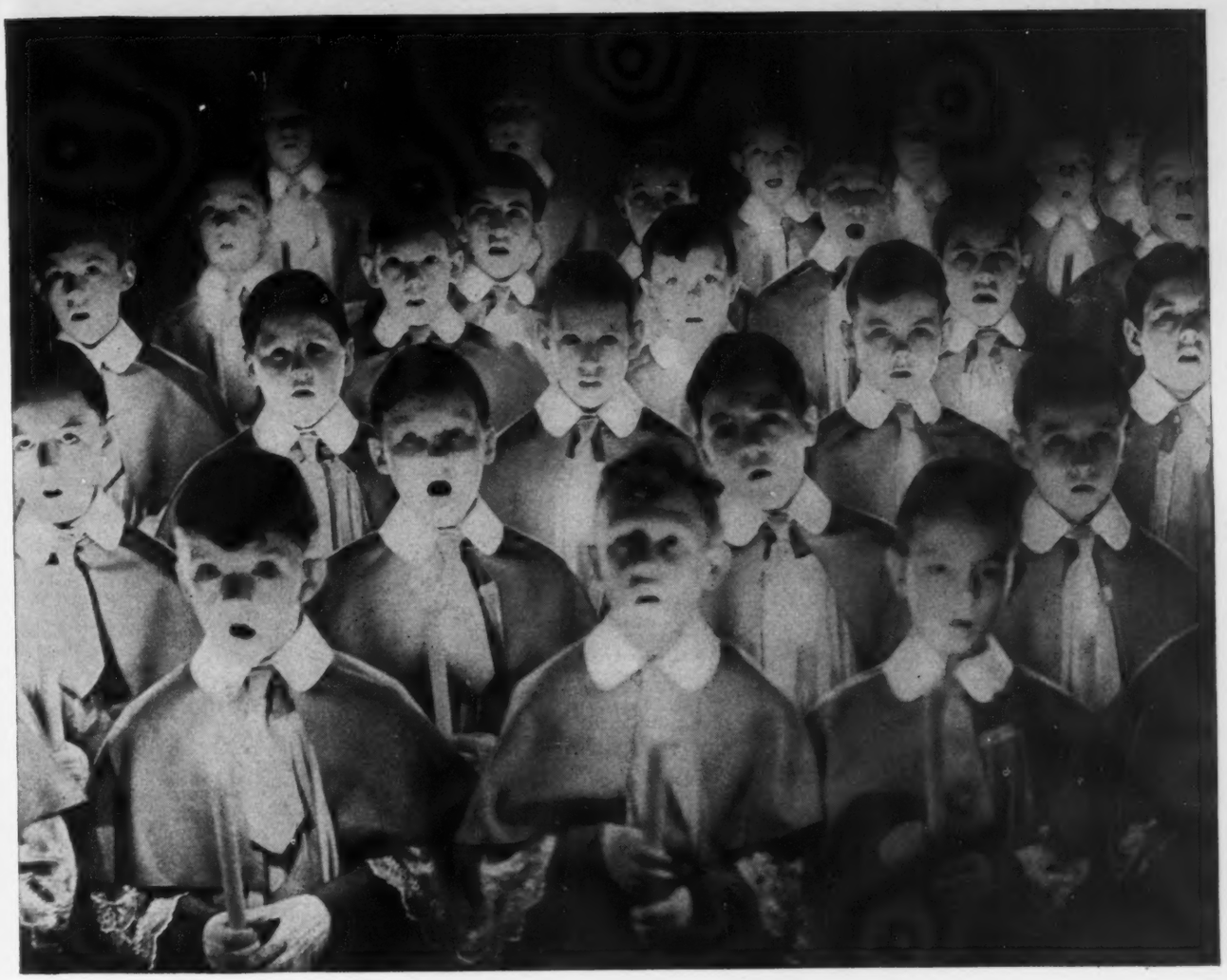
Neutralizer Flex-A-Plugs, installed at ends of branch circuits, protect against voltage build-up in secondary and give instant visual indication of phase failure.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY

PLAINVILLE, CONN.

THE TRUMBULL ELEC. MFG. CO. — PLAINVILLE CONN. U.S.A.

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES



There will be LIGHT

THE world has its shades drawn.

The warmth and welcome of good light is blacked out.

But it will not always be so. Even now a faint flicker is trickling through.

Look you in the factories of the homefront where men and women work and sweat and drive machines.

There you will find light.

Yes, there you will find light working, too . . . to deliver more of the goods of war, to help those handicapped by age or weak vision, to fight dangerous and costly accidents, to lift the morale of millions of heroes.

As production mounts higher and higher . . . as American boys in the Aleutians and Guadalcanal and Tunisia and all the other places of blood and war press forward . . . so will light come back to warm a cold world.

This is *another* December. It is but a short year from Pearl Harbor. A short year in which so much has happened. Light has helped in the accomplishment of these good things . . . but more than this, light is the beacon of hope and peace and goodwill for men of all nations.

So be of good heart . . . there will be LIGHT.

GOOD LIGHTING *has been the business of The Miller Company since 1844. In that almost-hundred years we have seen this country weather many wars and disasters. In that almost-hundred years we have learned much about giving man better light. Even today while we busy ourselves with our war tasks, we are learning still more that will mean better light for everyone, when comes the peace.*

THE MILLER COMPANY, *Meriden, Connecticut*

BUY U. S. WAR BONDS

NEW FOOTPRINTS

at the Old Watering Hole!

Electrical World's 39th Annual Statistical Issue to Record UNUSUAL Conditions

★ Statistics, like tracks in the earth to the savage, tell who has been where — and what happened.

When our friend Lo, the poor Indian, finds a flock of huge twelve-toe tracks he concludes that things have changed around the old watering hole—and steps must be taken.

Newly compiled statistics, therefore, are not dull digits and decimals, but *news* . . . indicating what has occurred and the path of things to come.

The point is that you're going to see footprints you never saw before in World's 39th Statistical Issue. For business has not been good — or bad — but *unusual.* And when these conditions are portrayed graphically you'll find lofty peaks and

deep valleys have appeared in former tableland . . . there are new trends, like flood rivers, blotting out the landscape. And former roaring freshets of activity have dwindled down to placid pools.

It's *war*—it's *Washington*—it's a series of unprecedented conditions—and it will be *hot news* to Electrical World readers who have been using these statistical issues as a yardstick to measure their own performance.

Listed here you will find the valuable data this issue will contain . . . all of it new, factual data about *your* industry that you should read, and use as a guide in the months ahead.

Watch for this important issue—Electrical World's 39th Annual Statistical Number—out January 23, 1943.

FACTS AND FIGURES AND WHAT THEY MEAN

- Figures on energy output
- Generating capacity
- Station economics . . . fuel consumption and efficiency, average hours of use, plant loading, capacity factor, etc.
- Energy sales by classes of customers
- Revenue by classes of customers
- Average revenue per kilowatt-hour by classes of customers
- The number of customers in different classes, both nationally and sectionally
- Operating expenses showing operating ratio
- Taxes
- Financing in terms of security issues, bonds maturing, etc.
- Manufacturers' sales

PLUS . . . ANSWERS TO IMPORTANT QUESTIONS LIKE THESE

- What has the appliance situation done to the domestic market?
- What have dimouts and blackouts done to street lighting?
- What has been the shift, if any, in customers?
- How many hours are machines now running on the average?
- What has the usage of older machines done to fuel efficiency?

This is just a sample of the important data that will appear in the 39th ANNUAL STATISTICAL NUMBER of ELECTRICAL WORLD

OUT JANUARY 23, 1943

ELECTRICAL WORLD

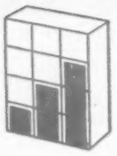
A McGRAW-HILL PUBLICATION—330 WEST 42 STREET, N. Y. C.

WESTINGHOUSE

Control Centers

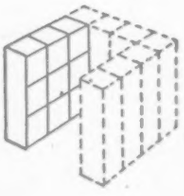
SPEED INSTALLATION • SAVE MANPOWER

TAKES ANY COMBINATION OF CONTROLS—Starters up to 100 hp, 440-600 volts a-c, fit interchangeably. All starter panel spaces are multiples of the smallest size.



FRONT ONLY, OR BACK-TO-BACK MOUNTING—Standard 20-inch depth gives compact structure, yet permits back-to-back mounting of all controls for even more compactness.

SELF-CONTAINED STRUCTURE EASILY ADAPTABLE TO SPACE AND SHAPE REQUIREMENTS—Control Center is completely flexible. Control units are front-connected—quickly interchangeable. Structures are self-contained and can be fitted to space requirements.



You can install motor starters faster—put them to work almost immediately—when you buy factory assembled Westinghouse Control Centers.

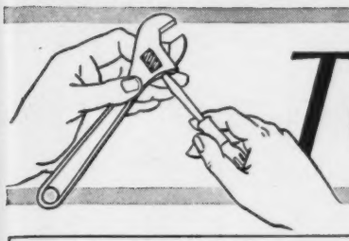
New Westinghouse Standardized Control Centers make it possible to obtain all the advantages of modern, grouped control at new low cost. They provide for grouping of combinations of control devices for motors up to 100 hp, 440-600 volts a-c.

Self-contained unit structures take interchangeable, prewired starter panels. Structures assemble into any floor plan arrangement—can be moved or changed easily at any time. Internal buses and wiring troughs simplify wiring, give maximum safety, and eliminate costly individual conduit runs.

Westinghouse Control Centers safeguard workers, make electrical maintenance easier, and reduce outage time. Get the full story! Write for booklet 3026. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

I-21218

Westinghouse CONTROL CENTERS



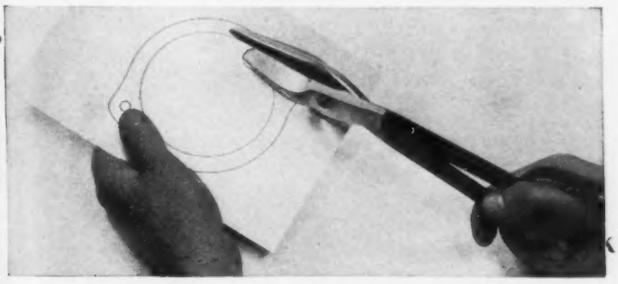
TOOL NOTES

Maintenance and Repair Suggestions to Prolong Tool Life

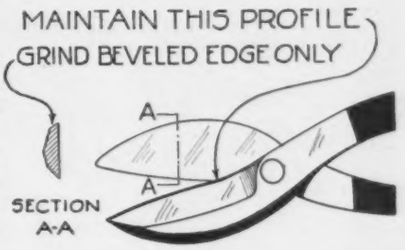
No. 7 NOTES ON USE AND CARE OF CRESCENT SNIPS

Crescent Snips are made in the four styles illustrated below. The *Standard* Pattern is the most generally used type and is designed for cutting straight lines or circles of fairly large radius. Available in 8 sizes, from 7 to 14" overall length. The *Combination* Pattern, designed after conventional "circular cutting" types, will cut curves as well as straight lines. Made in one size only with an overall length of 12-3/4". The *Heavy Duty* Pattern is a rugged, powerful leverage snip for heavy work. It will cut curves as well as straight lines. One size, 16-1/2" overall length. The *Circular Cutting* Pattern is designed especially for scroll work and intricate patterns. Two sizes, 7" and 12-3/4" overall length.

The terms Right or Left Hand *Snips* and Right or Left Hand *Cut* are often confused. A Right Hand *Snip* has a Left Hand *Cut*, i. e. it cuts to the operator's left of the top blade, thus enabling a right-handed operator to see the line of cut. The reverse is true of Left Hand Snips. All Crescent Snips are Right Hand Snips.



REGRINDING. The blade contour of Crescent Snips is the result of considerable research and experiment. It is so designed as to present an efficient shearing angle throughout the full length of the cutting stroke. When regrinding, it is therefore important to maintain the original blade contour. Grind only the bevel edge of the blade and only in an amount necessary to restore a clean, sharp edge.



In reassembling the blades, take care not to overtighten the bolt. This caution applies particularly to Crescent U-412 and U-416 snips. Blade tension in all Crescent Snips is attained originally by grinding (not springing) the blades to shape.

COMMON ABUSES. Overloading, by trying to cut stock beyond the capacity of the snip, or forcing the cut by hammering the handles, is poor practice. Cutting wire with snips, likewise, constitutes abuse. This is particularly true with snips having inlaid blades although since Crescent blades are solid forgings and hardened clear through they are less likely to be damaged by this practice. With intelligent use and normal care, Crescent Snips will retain their clean shearing edges for a long time. Keep joint oiled at all times. Prevent rust by occasionally wiping with oiled cloth.

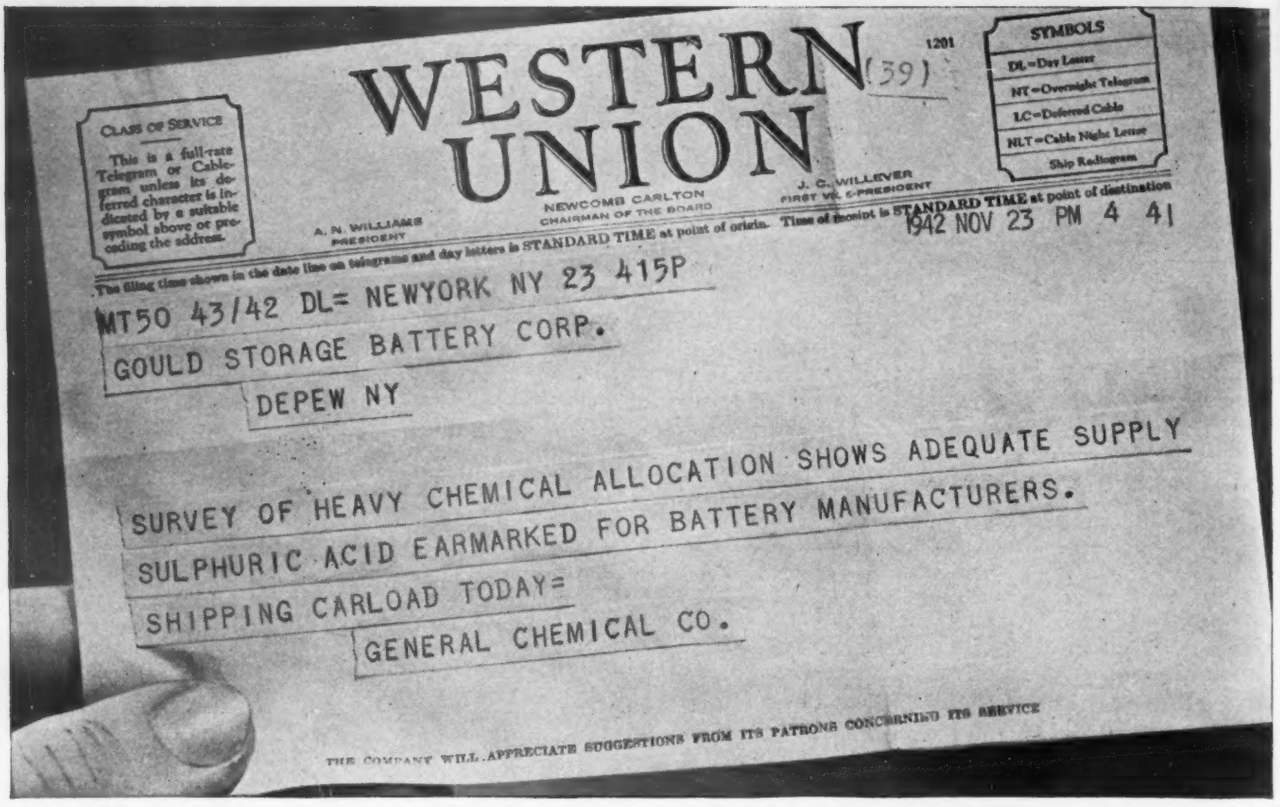
REPAIR PARTS. Bolts and nuts are available for all Crescent Snips. Snip "halves" cannot be supplied as they must be made up in pairs and matched at the factory.

HOW TO USE SNIPS. First mark or scribe the work to accurately locate the line of cut. With the cutting edge of the upper blade directly on the scribed line, begin the cut with the metal well back into the throat of the snips. Stop the cut just before you reach the end of the cutting stroke and repeat the operation by taking another full "bite". If you permit the snip to cut clean through on each stroke, a burred or ragged edge will result and it is more difficult to follow a scribed line. Standard Pattern snips are best for cutting long, straight lines as the flat inside surface of the blade acts as a guide.

When making short cuts of limited length, open the jaws just far enough to permit the desired length of cut. Then cut through with one stroke to the end of the blade. To cut an inside curve, first drill or punch a hole of sufficient size to permit entry of the blade tip. Then gradually spiral out to the scribed line as indicated in the illustration above.

CRESCENT TOOLS
Give Wings to Work

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.


WESTERN UNION
1201
(39)
SYMBOLS
DL=Day Letter
NT=Overnight Telegram
LC=Deferred Cable
NLT=Cable Night Letter
Ship Radiogram
CLASS OF SERVICE
This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.
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NEWCOMB CARLTON CHAIRMAN OF THE BOARD
J. C. WILLEVER FIRST VICE-PRESIDENT
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SURVEY OF HEAVY CHEMICAL ALLOCATION SHOWS ADEQUATE SUPPLY
SULPHURIC ACID EARMARKED FOR BATTERY MANUFACTURERS.
SHIPPING CARLOAD TODAY=
GENERAL CHEMICAL CO.
THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

There's no substitute for the lead-acid battery

...choose GOULD PLANTE

for control and emergency lighting operations

RATED CONSERVATIVELY—Goulds will *equal or exceed* in capacity any battery of comparable size and cell structure. Buy on proven performance and you will buy Gould!

AT PEACE OR AT WAR, industry can't get along without dependable, long-lived lead-acid type batteries. The acid has to be sulphuric—nothing else will do. That's why Gould is able to obtain sufficient sulphuric acid to maintain production on critically needed industrial types.

New batteries are available—but don't buy unless you have to! Get the most out of your present Gould Plante. The exclusive Gould method of forming spun plates of pure lead permits the full capacity of the plates to be used—which means that Gould Plante will deliver, not years, but decades of service.

FREE HELP ON BATTERY PROBLEMS—Your Gould Service Man will help you get full service from your present equipment, regardless of make. No charge, no obligation. Write Gould Storage Battery Corp., Depew, N. Y. Ask for FREE descriptive literature on any type of industrial installation.

GOULD THE BATTERY PICKED BY ENGINEERS

WOLVERINE SALUTES
THE TEN WINNERS

In recognition of their noteworthy contributions to the war effort, ten men were invited to the White House on December 10 to receive individual awards personally bestowed on them by President Roosevelt.

In this ceremony, the first of its kind in the country's history, six of the workers, chosen from the war industries in cooperation with local labor-management committees, received Citations of Individual Production Merit, signed by Donald M. Nelson; and the four other workers received Certificate Awards.

Wolverine's salute to these men carries a deep feeling of pardonable pride because among them is one of our own men, Walter P. Hill, whose development of a new process of manufacturing primer tubes is now used in the firing mechanism of millions of large shells. Through his untiring efforts many worthwhile savings in critical materials have been effected, and great reductions have also been made in man-hours and machine time.

WALTER P. HILL
"Production Soldier"

The Citation Award winners, in addition to Hill, are: Joseph H. Kautsky, Link-Belt Co.; Clinton R. Hanna, Westinghouse Electric and Mfg. Co.; Edwin Curtiss Tracy, RCA Manufacturing Co.; Madison E. Butler, Stromberg-Carlson Telephone Mfg. Co.; and James A. Merrill, Goodyear Tire and Rubber Co.

Certificate Awards went to George Smolarek, Packard Motor Car Co.; Daniel Walter Mallett, Borg-Warner Corp.; Herbert Ruper James, National Tube Co.; and Stanley Crawford, RCA Manufacturing Co.

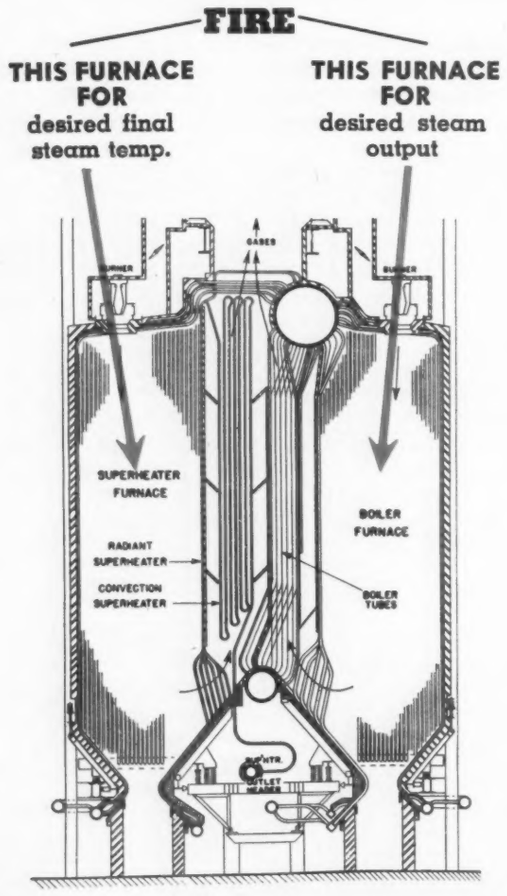
Men, you've done it! We're proud of you, and we are happy in the thought that you are receiving the public recognition you deserve. We hope your achievements will serve as stimulants to even greater employee participation in factory suggestion-box system, where more good ideas may be born and mature into helpful devices that will bring us an early peace.

WOLVERINE TUBE DIVISION
OF CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
Seamless COPPER • BRASS
1427 CENTRAL AVENUE • DETROIT, MICHIGAN

OPERATING ADVANTAGES OF TWIN FURNACES

1. WIDEST RANGE OF SUPERHEAT CONTROL
2. SLAG FREE OPERATION
3. OVERHEATING OF SUPERHEATER ELIMINATED
4. HIGH AVAILABILITY
5. LOW DRAFT LOSS
6. HIGH RATE OF CIRCULATION

→ because SUPERHEATER FURNACE IS SEPARATELY FIRED



The high availability and dependable performance of Twin Furnaces are dependent on these characteristics inherent in the design:

1. Maximum water cooling surface per cubic foot of furnace volume gives low furnace exit gas temperatures that minimize slagging.
2. Superheaters not subjected to over-heating when starting up.
3. Elimination of excessive steam temperatures resulting from reduced feedwater temperatures.

The Army-Navy Production "E" has been awarded to Foster Wheeler in recognition of quality equipment, in quantity, on time.

FOSTER WHEELER CORPORATION

165 Broadway, New York, N. Y.

FOSTER WHEELER

Like sentinels they stand, these sturdy structures of steel that support America's super-highways of electric power. Yet their strength is such that the forces of storm and flood and frost leave them untouched. They are built for stresses such as they will probably never be called upon to meet. It is this dependable sturdiness—also reflected in low maintenance cost—that makes Blaw-Knox transmission towers so well-liked by operating engineers. Into them go highly specialized skills in designing, fabricating and galvanizing. Blaw-Knox can be of inestimable help to anyone with a power transmission problem. A discussion is invited.

BLAW-KNOX TRANSMISSION TOWERS

W-KNOX DIVISION OF BLAW-KNOX COMPANY 2013 FARMERS BANK BUILDING, PITTSBURGH, PA.
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

There's a NATIONAL ELECTRIC GORILLA GRIP MECHANICAL CONNECTOR *for every conductor no matter where it taps or terminates*

TYT - BUS TAP
1¼ I.P.S. AND LARGE
YFD - CONNECTOR
TO SPECIFICATIONS
GFE - STUD CONNECTOR
2 STR. TO 2000 MCM
GM2 Y90° - CABLE TAP
TO SPECIFICATIONS
GMO - SQUARE FLANGE LUG
14 SOLID TO 2 STR.
GY - 90° CABLE TAP
8 STR. TO 2000 MCM
PY - TWO WAY
8 STR. TO 2000 MCM
YS2 - TWO WAY
14 TO 2000 MCM
SCRUWEDGE OFFSET TONGUE
14 SOLID TO 2 STR.
PYT - EQUALIZER TAP
8 STR. TO 2000 MCM
S - STRAIGHT CONNECTOR
2 STR. TO 2000 MCM
G - SQUARE FLANGE LUG
2 STR. TO 2000000 CM
Y - SQUARE FLANGE LUG
8 SOLID TO 2" I.P.S.
YS3 - THREE WAY
14 TO 2000 MCM
SS - SCRUWEDGE STRAIGHT
2 STR. TO 14 STR.
YS45° - CABLE TAP
14 TO 2000 MCM
GBT - BUS TAP
2 STR. TO 2000 MCM
GMP - POT HEAD STEM
2000 MCM AND SMALLER
YY90° - CABLE TAP
2/0 STR. TO 1000 MCM
GY - 90° CABLE TAP
BRANCH—1250 MCM OR LARGER
YSP90° - CABLE TAP
14 TO 2000 MCM
YFE - STUD CONNECTOR
1 STR. TO 2000 MCM
GMU - THREE WAY CONNECTOR
2 STR. TO 2000 MCM
LG - 90° ELBOW CONNECTOR
2 STR. TO 2000 MCM
TG - THREE WAY TEE
2 STR. TO 2000 MCM
YYC - CROSS-OVER CONNECTOR
8 STR. TO 2000 MCM
YRA - SQUARE FLANGE LUG
8 SOLID TO 2" I.P.S.
3AG - AERIAL CONNECTOR
500 MCM AND LARGER
G - ROUND FLANGE LUG
2 STR. TO 2000000 CM
GMBT2 - BUS TAP
2 STR. TO 2000 MCM
YSE - SQUARE FLANGE LUG
8 SOLID TO 2" I.P.S.
1AG - AERIAL CONNECTOR
2000 MCM AND SMALLER
YS4 - FOUR WAY
14 TO 2000 MCM
TYG - BUS TAP
1¼ I.P.S. AND LARGER
GFT - CABLE CONNECTOR
2000 MCM FEEDER CABLE
SS - STRAIGHT CONNECTOR
2 STR. TO 2000 MCM
3G - AERIAL CONNECTOR
300 MCM AND LARGER
Mechanical Principles of GORILLA GRIP Electrical Connectors

Please write us for this semi-technical booklet.

NATIONAL ELECTRIC PRODUCTS — NE — WIRING SYSTEMS 6 — WIRES AND CABLES

National Electric Products Corp.

Pittsburgh, Pa.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

1600-1604 53rd Street, North Bergen, N. J.

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MOTOR GENERATOR SETS

1—75 KW, 125 volt, General Electric, Sq. Cg., 25 cycles.
1—75 KW, 125 volt, General Electric, sq. cg.
1—50-kw., 250-V., G.E., Sq. Cage.
1—15 KW, 230 volt, GE, Squirrel Cage.

TURBINES

3—1000-kw., 2300 volt, condensing.
1—500-kw., General Electric, 3 phase, 60 cycle, 480 volt bleeder.
1—300 KW, 2300 volt, Westinghouse, non-condensing.
1—300-kw., 3 phase, 60 cycle, 220 volt, General Electric, condensing.
1—200-kw., General Electric, condensing.

TRANSFORMERS

2—400 KVA, General Electric, 4150-240/480 volts.
4—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, Pittsburgh, 15,000/7500-110/220 V.
4—200-kva., Pittsburgh, 7800/200/110 volts.
3—150-kva., Pittsburgh, 6600/440 volts.
18—150-kva., G.E., 3 phase, 4150-120/208 v.
6—100-kva., Westinghouse, 13,200-250 volts.
3—75-kva., G.E., 2200/220/440.
3—50-kva., Wagner, 4150-220 volts.
2—50-kva., Pittsburgh, 15,000/7500/110/220 volts.
3—37½-kva., General Electric, 2400/240/120 V.
3—25-kva., Westinghouse, 440/220-220/110 volts.

MOTORS—3 PHASE, 60 CYCLE

No.	H.P.	R.P.M.	Volts	Type
1	720	360	440	G.E. Syn.
1	560	1200	440	G.E.
1	400	514	440	West. Sl. Rg.
1	350	300	440	G.E. Sl. Rg.
1	350	100	220	G.E. Syn.
2	335	600	2200	G.E. Syn.
1	300	720	2200	G.E. slip ring
1	250	514	4000	G.E. Syn.
1	200	600	550	G.E. sq.
1	200	600	440	Crock Wheeler S.L. Rg.
1	100	1800	440	West. sq. cg.
6	100	900	440	West. sq. cg.

VARIABLE SPEED 230 VOLT MOTORS

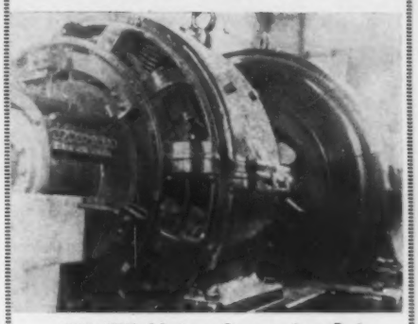
H.P.	R.P.M.	Type
2—100 Hp. Electro Dynamic, 475/1375 RPM.		
90	470/940	G.E.
75	525/1050	E.D.
1— 60	600/1200	G.E.
1— 60	500/1000	Diehl
1— 35	500/1500	Westinghouse
1— 35	Electro Dynamic, 350/1000 RPM.	
1— 30	225/900	Crocker Wheeler
2— 25	300/900	Electro Dynamic
1— 15	300/1200	G.E.

ENGINE SETS

13x15 Skinner Uniflow, 150/300 RPM, engine only.
16x36, Hamilton Corliss, heavy-duty, with 165 KW, 3 phase, 220 volt General Electric Generator.
120 KW, G.E., 3 phase, 220 volt, with Ames uniflow engine.
50 KW, Westinghouse, 3 phase, 320 volt; Fairbanks engine.

Complete Line of A.C. and D.C. Motors and Generators

MOTOR GENERATOR SETS



750 KW Motor Generator Set

Code SEA 554 — 1—750 KW WESTINGHOUSE MOTOR GENERATOR SET: GENERATOR: 750 KW, D.C., 650 volt, 1,155 amp., 500 RPM. MOTOR: 1,020 HP, induction, constant speed, 3 phase, 60 cycle, 2,200 volt, type HF, 500 RPM.

SEA 8 — 2—50 KW WESTINGHOUSE MOTOR GENERATOR SETS: GENERATORS: 50 KW, D.C., 125 volts, 400 amps., 690 RPM. MOTORS: 75 HP, induction, constant speed, 3 phase, 60 cycle, 400 volt, type CCL, 690 RPM.

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SAN FRANCISCO — NEW YORK
LOS ANGELES — NEW ORLEANS
PORTLAND — BUTTE

ROTARY CONVERTERS—3 PH. 60 CY.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200

ROTARY CONVERTERS—3 PH. 25 CY.

3—1500	G.E.	500	225/275	6600
1— 600	G.E.	750	225/275	6600

M.G. SETS—3 PH. 60 CY.

1—1500	G.E.	720	600	6600
1— 500	Whse.	720	250	2300
1— 500	G.E.	720	600	13200

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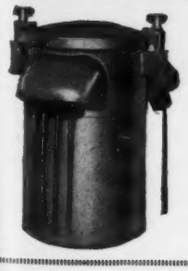

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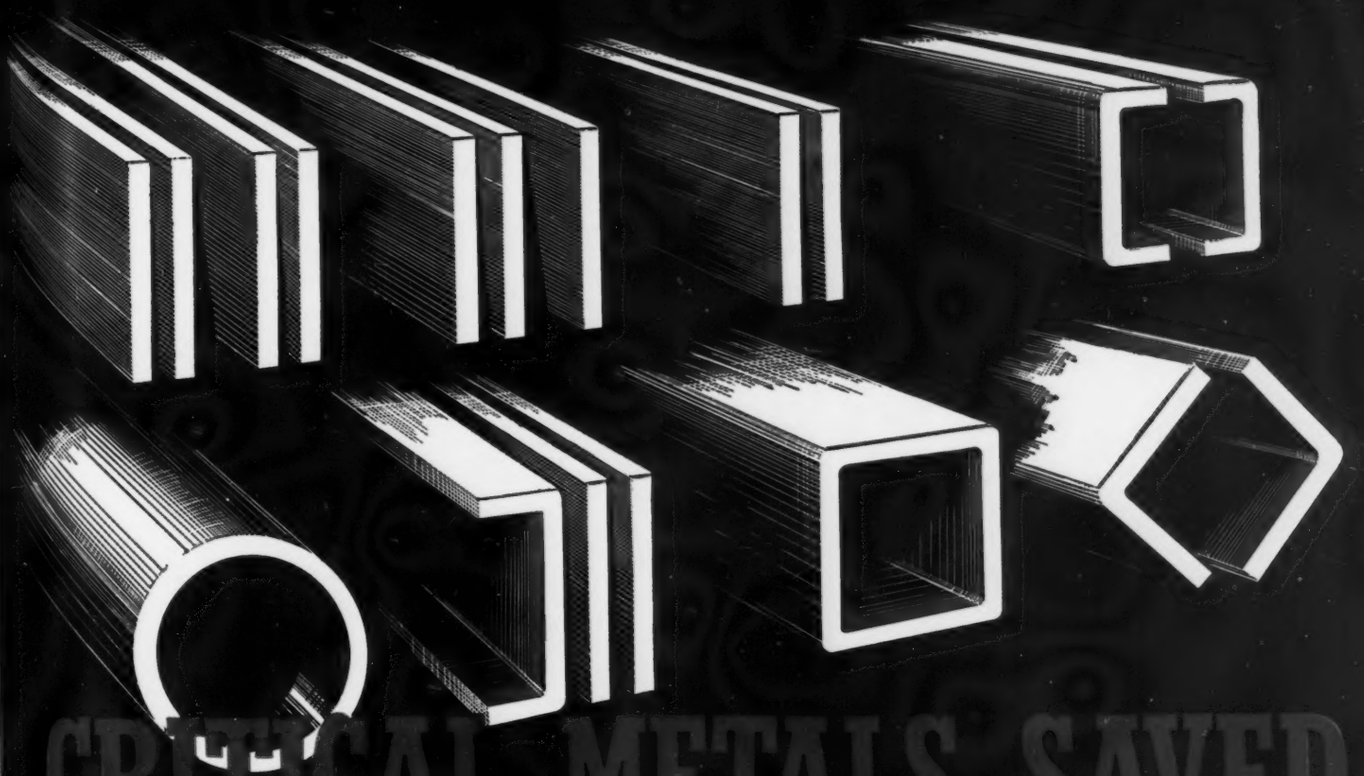
★ **These companies have supplied additional buying information on their products in the 1942 edition of the Electrical Buyers' Reference**



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